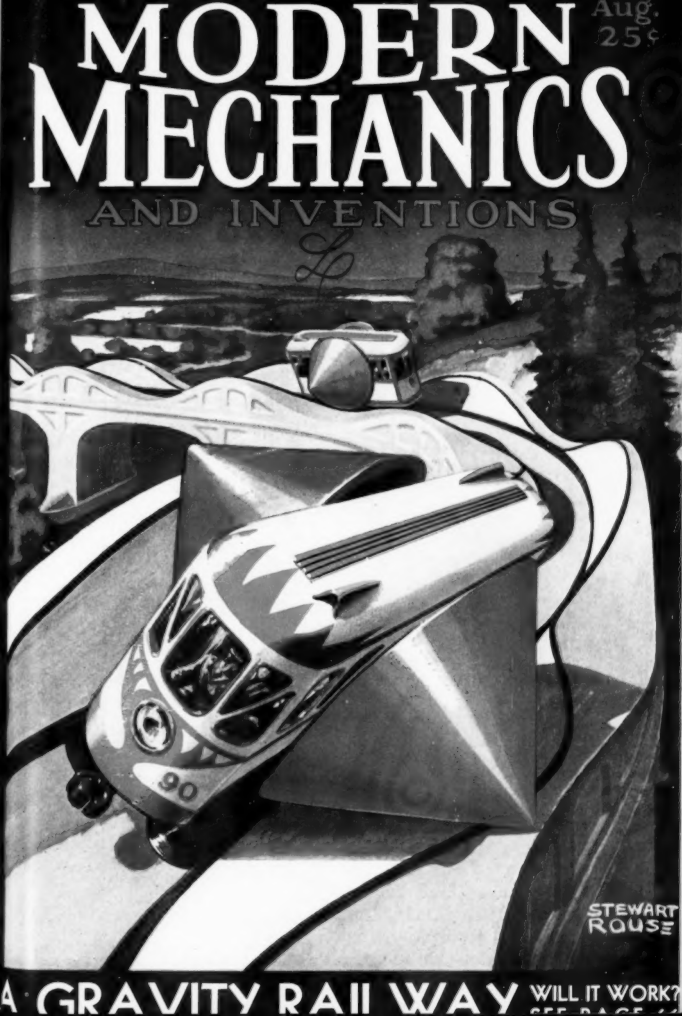
MODERN MECHANICS

AND INVENTIONS

Aug. 25¢



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Vol. IV -- No 4

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MODERN MECHANICS AND INVENTIONS

AUGUST, 1930

PRICE 25 CENTS

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COMING IN SEPTEMBER

A fascinating "behind the scenes" story of how movie scenes are faked, written by Hollywood's foremost designer of miniature movie sets, leads off the September Modern Mechanics, on sale August first. Also the first installment of plans for the Georgia Special High-Wing Monoplane, and a score of other timely features and how-to-build articles which make this issue one of the best yet. Reserve your copy now.

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They Told Him Salesmen Were "Born"

But Now He Makes $10,000 a Year ...Thanks to This Little Book

IT was just a little free book that made the difference between Ed Pinkham and the rest of the men in our shop. Nobody ever imagined that Ed would land, even in the $5,000-a-year class, let alone be making $10,000 before he was thirty. Ed didn't know himself the abilities he had in him as a money-maker.

But one day, a strange occurrence changed his whole life. During his lunch hour Ed started to read a little book he had brought to work with him.

"It's a book called 'The Key To Master Salesmanship,' Bill," he told me. "It's the most amazing thing I ever read. I never dreamed there was so much in salesmanship. You ought to send for a copy yourself. It's free."

"Huh!" said Luke Jones. "Does that book tell you how to become a salesman?"

"It sure does," replied Ed, enthusiastically.

"Don't waste your time," advised Luke. "You can't learn how to be a salesman. A fellow has to be 'born' that way to be a good salesman."

Ed just smiled at that, but he said nothing. Soon afterward he quit the shop, and we forgot about him. And then last night, I met Ed again—driving a snappy new sedan and dressed like a million dollars.

"For Pete's sake," I said. "What are you doing nowadays, Ed?" He smiled. "City salesmanager for the Steel Castings Company," he told me. "What are you doing?"

"Still at the shop," I replied. "But what I want to know is, how do you come to be salesmanager for Steel Castings? They're one of the biggest firms in the business."

Ed smiled again. "Remember that book on Salesmanship that Luke Jones was kidding me about one day? Well, when I finished my Salesmanship training the Association I took it from gave me a choice of twenty-one jobs through their Free Employment Department. I got a wonderful job, and I had a wonderful training so I've had a pretty successful time of it. They made me City Sales Manager three months ago at ten thousand dollars a year."

"Good night!" I said. "And Luke and I are still punching the old time clock!"

Ed looked at me seriously. "See here, Bill," he said. "Are you sport enough to risk two cents that you can do as well as I did? Then spend the two cents to write to the National Salesmen's Training Association tonight and get their free book. Then take their course. When you have your diploma, their Free Employment Department will help you get a good sales job—every year they have calls for over 50,000 salesmen. Not only will they help you get the job but they give you an iron-clad money-back guarantee that you must be satisfied with the training received—or they refund your tuition!"

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Cover Design Painted by Stewart Rouse

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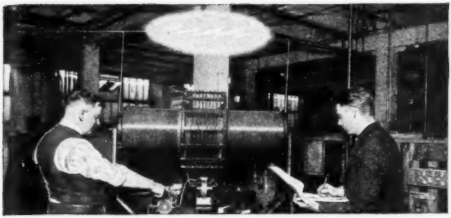

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Photo shows the attractive T.A.T. Airport at Columbus, Ohio, one of the stops on the Transcontinental Tours.
(Underwood and Underwood Photo)

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To qualify you must be properly trained. Learn how easily in only 8 weeks by the simple, direct McSweeny Shop Plan, you can qualify for an expert automotive mechanic job paying $40 to $150 weekly.

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The McSweeny practical Shop Plan is the short-cut to quick success. You learn in the same type of shop, that 8 weeks later, you will be qualified to work at big pay. You don't have any tedious book study. No lessons. It doesn't take 18 months or more to finish. You learn by actual doing on real equipment—no theory, no guesswork. You get PRACTICAL Training.

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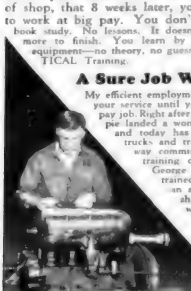

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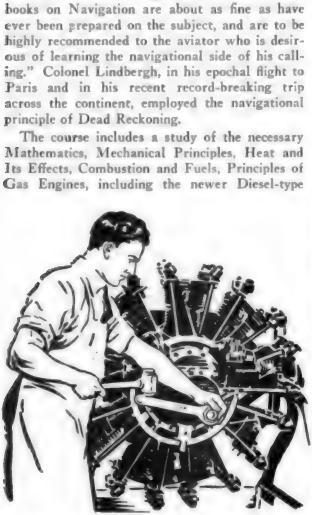

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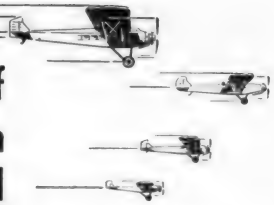

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(Above) *Facsimile of telegram recently received from Mr. Carl B. Squier, General Manager, Lockheed Aircraft Corporation.*

(Left) *Student and instructor repairing a Wright Whirlwind engine at Parks Air College.*

EVERY young man who is interested in aviation as a life work should read carefully the telegram reproduced on this page.

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I send you this book FREE in connection with my offer to train you at home in drafting. Jobs waiting for draftsmen.

The higher positions in plants, factories and business houses are filled by men with a foundation originally as Draftsmen.

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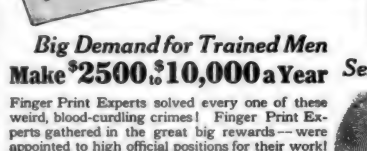
THREE bloody finger prints on the cash register! He might as well have left his calling card — his doom was already written! These silent witnesses told the story — identified him — convicted him! Live through these thrilling adventures right with Detective McDonald as he gets Arizona's first finger print conviction. Mail the coupon below and get this gripping story FREE, with 12 others just as exciting!



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Operators are needed continually for commercial land stations being opened in our leading cities.

Radio factories employ thousands. Salaries for well trained men range from $1,800 to $5,000 a year and over.

J. E. Smith

There is a shortage of Radio Operators for positions on board Ship, in Commercial Land Stations, Broadcasting Stations and Aviation. Get one of these jobs for yourself. I'll train you inexpensively right at home in your spare time. I have trained hundreds—have doubled and tripled their salaries. Proof of this is in my book "Rich Rewards in Radio." Mail the coupon for a copy today.

I'll teach you the secrets of Radio, Television and Talking Movies

You're not a "one job" man when you finish my complete course. You know Radio principles as used in Broadcasting Stations, Commercial Land Stations, on board Ship, in the manufacture and servicing of sets—you'll know how Radio is used in Aviation, in Talking Movies and Television. You'll be trained for many lines — have many branches of work to choose from. You need not be a high school or college graduate. Many of my most successful graduates did not finish grade school.

Many make $10 to $25 a week in spare time while learning.

The day you enroll I'll show you how to do ten jobs common in most every neighborhood. Throughout your course I will show you many others. I not only show you how to do the jobs but also tested plans and ideas for getting them. Hundreds of "my boys" make $200 to $1,000 while they are taking this course. My course is world-famous as the one that pays for itself.

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I will not only train you quickly and inexpensively at home during your spare time, but when you graduate the services of my Employment Department will be open to you as long and as often as you need its help. There's no charge to graduate or employer.

I'll refund your money if you're not satisfied

I'll refund every penny of your money if you are not satisfied, upon completing, with the Lessons and Instruction Service. Behind this agreement stands the National Radio Institute—the Pioneer and World's Largest organization devoted exclusively to training men and young men for good jobs in the Radio industry. You are the only judge.

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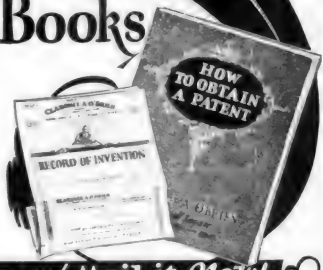

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The SHOP MAIL BOX

Andy, Modern Mechanics' ink-slinging Grease Monkey and general buck passer, takes you into the double M hangar each month for a look-see at new material which is "on the make." He tells of last minute news, all about the writers who tickle your reading taste with highly original story ideas, and of inside gossip you can't get elsewhere.

THAT'S a swell blurb off up there to the right, isn't it? Ought to be—I okayed it! It's the truth, though, Gang, that I can pass along stuff you'd never hear of anywhere else. And because I've got plenty to unload this month I'm savin' my breath on preliminaries. Got to conserve space because I want to run a lot of the photos you've been good enough to send me. So here goes the first line o' type—a letter from Jack Hague from down in Savannah. Right from the shoulder it is, and it hits me between the eyes without stammering!

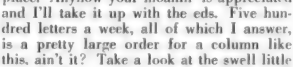
Savannah, Ga.

Dear Andy:

Your magazine'd be good if you weren't in it, and that goes double on Sundays. When a fellow writes you a good letter you ought to put it in your department instead of holding it out and sounding off with your own tripe. Do something about this or I'll quit reading your o'd magazine.

JACK HAGUE.

Shame on you, Jack—twice in the same place. Anyhow your moanin' is appreciated and I'll take it up with the eds. Five hundred letters a week, all of which I answer, is a pretty large order for a column like this, ain't it? Take a look at the swell little semi-demi cruiseola down at the bottom of



the page, and swipe a watermelon from Widow Parson's back lot. That combination'll cure any stomach ache in America.

* * *

William Murtha, and John Chiappa, both of Brooklyn, have built a hull from the plans of *Miss Modern Mechanics*, that step hydro published not so long ago. They report excellent progress and satisfaction.

(Continued on page 24)

A later version of "Allegra," one of Modern Mechanics' most popular how-to-build articles, is shown here cruising along in deep water off shore. This boat is equipped with a step. "Allegra" appeared in the May, 1930, issue.

What do they say behind your back?

It isn't what they say to your face—It's the whispers that circulate behind your back that tell what folks really think about you

I STEN to what they say about the other fellow—

"I certainly pity Mrs. Jones. John says her husband is only a clerk and never will be much more."

And then this one—

"That's the Mr. Smith who just built that new house around the corner. They say he was a bookkeeper a year ago and now he is Assistant Auditor. He must be a comer."

Are you proud of what they say about you—or ashamed?

How can you make sure that what folks say about you in the future will be good?

There is just one way—get into the success class—the progressive group that people look up to and admire. Go after more money by learning to earn more. You'll be surprised to find how easy it is when you once get going. The start is the hard part.

Then—what people say behind your back will take care of itself—it always does.

Now—what would you say about the following three men?

This man changed the comments —he built his own business

Life looked to Lewis E. Bartlett much as it looks to many men and as it may look to you. A university man and a war veteran with a fine record, the after-war years found him trying vainly to find his niche. First a bank, then a department store and then a wholesale grocery house—in each a fairly successful record. But because he had no specialized training, the way to the top seemed closed.

Then he enrolled for training in Higher Accountancy and afterward in Law. Today he is a member of the bar and is serving as legal and accounting counsel for a number of corporations. His income is very satisfactory, he is his own boss, and best of all, the path to outstanding success is wide open.

Increases earnings 600 percent

When we first came in contact with Albert L. Russell of Victoria, B. C., Canada, he was a routine worker in a radio plant—and his salary was just as ordinary as his job. Within three months of his enrollment in LaSalle Modern Salesmanship training, he was offered a radio sales position with an increase of 100 percent. He accepted and six months later a larger house, attracted by his sales record, bettered him and his earnings went up another 100 percent. Today he finds his earning capacity has increased 600 percent.

Order clerk to general manager

Back in 1920, V. G. Powell of New York, was a young order clerk—in 1924 he was directing sales and advertising—a year later he was general manager. In between were five years of capable, loyal service and two completed LaSalle courses—Modern Business Correspondence and Business Management.

Six months after starting his first course, he asked to handle correspondence and got the job and a raise; a few months later he suggested a new sales promotion department and was given the responsibility of organizing and directing it; soon after he recommended the beginning of advertising and was given that task.

No wonder he moved up fast. Any employer would welcome and reward initiative and ability like that.

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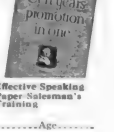

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Just tell me how much you want—
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The Health-O Quality Products Co.
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C. W. Van De Mark, President
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Dept. 2034-HH, Health-O Bldg., Cincinnati, Ohio

Dear Van: I hereby apply for position as "partner" in my town on your new cash pay agreement. Send your generous offer of $13.00 worth of products to start me and your written guarantee. Also tell me how I can make money saving the 20 magic words that make fortunes. *This is not an order—send nothing C. O. D.* I risk nothing.

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Andy Prints a Double-M Photo Album

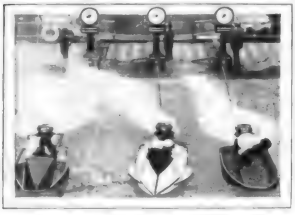
(Continued from page 20)

MODEL airplanes are big medicine with all lads from eight to eighty and we take pleasure in announcing to the world at large that a real live gasoline powered baby airplane model, with a nine-foot spread, will be seen in the next issue of the FLYING MANUAL. Hi Sibley is the lad who's doing this job, and unless he announces she won't fly, you'll find her on the newsstands along in October. Keep your eye peeled!

The Grey Goose Glider fuselage is easy to build.

Here's a bunch of the snapshots you monks have sent me in your various letters. Don't think I don't appreciate 'em, either. And I bet the other fellows who are double M fans get a kick out of seein' things that other fans have found absorbingly interesting. Here's the Grey Goose Glider fuselage. The Grey Goose Association advertises in this sheet, as you'll see elsewhere. They report a rapidly mounting membership. Looks like the Grey Goose Glider is simple, substantial, and easy to build, eh?

The other pix on this page have interesting histories. Below is a shot of three little outboard hydros that were used in a publicity stunt anent the recent Los Angeles boat show. The little wagons were put in a swimming pool where they are shown pulling Toledo scales. The value of these tests is inconclusive, as the wheels were running at zero efficiency and the scale pull doesn't mean a thing.



Here's one way of testing the comparative speed of boats—static tests with scales.

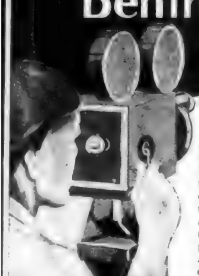
Off to starboard is a shot of Ed Heath in the newest lightplane symphony he has concocted. This is the new Parasol. It is as much an improvement over the Parasol shown in the original FLYING MANUAL as that Parasol was over an old Curtiss front seater. Note the new side door, and the V struts, a la monocoupe.

The little silhouette above is Bill Atkin's drawing. You mark my word about Billy being in demand by other mags! You'll remember from a couple of issues back that William Atkin was discovered to the field of mechanical magazines by old double M. Bill's little 19 ft. cutter is on the make for an early issue. We predict other mags will have to come to the w.k. MODERN MECHANICS policy of going out and getting experts to do their stuff. Take Bill, for instance. He knows boats. Ergo, say the eds, he is the man to have to do us a design. Hence we brought him to your attention. And mark us, old timer, when we say we're taking a lead on stuff like this, because you'll find double M authors are in highest demand among editors in this mechanical magazine field. And what's more, we're sports enough to say to the author, "Sure—hop to it!"

Andy has told you about the new Heath side door air pullman. Here she is. Easy to bail out.

(Continued on page 26)

Be The Man Behind The Camera



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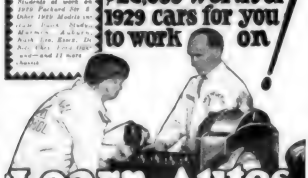

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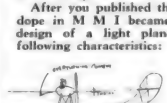
Sam Rabl Writes the Eds a Letter

(Continued from page 24)

SAM RABL, plane and boat designing genius of the Martin factory, sends a letter to Westy Farmer concerning an idea that popped into the noodles of the twain some weeks ago. The idea was to build a light seaplane or flying boat that would really fly from the surface of the innumerable lakes of the country. Sam's letter is a revelation; I run it as Westy has given it to me, knowing it'll hit the bull's-eye:

Dear Westy:

After you published the light flying boat dope in M M I became interested in the design of a light plane to embody the following characteristics:



Sketch One

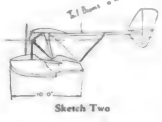
(1) The boat should be of such a size that it would fit in the ordinary boat house and to accomplish this the wings should be removable with the minimum of labor.

(2) The job must be within the ability of any ordinary amateur mechanic with the minimum of machine tools. Welding as an expensive operation should be kept down to the minimum as also would be the metal work.

(3) The job must be eminently airworthy with the minimum of power, and landing speed low at the expense of flying speed and climb, as there wasn't the necessity of getting her out of a small field.

(4) She must fly on the ordinary Harley or Indian conversion without the necessity of the highly souped up motor—17.5 h. p. was chosen as the maximum brake horse power available.

(5) It was decided at the offstart that we would not be wedded to any one particular type that fulfilled the above considerations.



Sketch Two

Well, to make a long story short, we worked on three different types as per sketches Nos. 1, 2 and 3. My first assumption was that the

(Continued on page 28)

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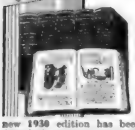

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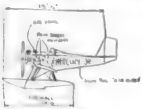
Andy Continues Rabl's Letter

(Continued from page 26)

flying boat would be the lightest (we decided 500 lbs. as the maximum) but subsequent calculations proved the error of this assumption and the twin float job won out. We seemed to think that by saving the weight of a fuselage we were doing something and besides the boat hull eliminated the weight of the inside skins of two floats of equal displacement to the hull. Bottom pressures raised the weight of the plywood of the hull so much that the saving of weight over the pontoon sides was almost eliminated. By the time that wing tip pontoons were added the twin floats won out. Westy, it almost broke my heart to see that boat proposition go up in smoke but there were other things more grievous against it than a mere matter of weight (see sketch No. 1). Aerodynamically she was as clean as a whistle and for looks she was a knockout. By the time figures proved her wrong it was like losing a real friend.



Sketch Three

We next investigated the sesqui plane with boat hull. But first let me gam off the wrongs of No. 1. Well, to begin with, we decided that in case of a crash none of us wanted to act as a nice soft cushion for the motor. The problem of getting gas up to the motor became a serious one and the placing of the motor in the hull was tabooed by the uncertainty of chain gear drive even though it made a wow of a reduction gear. The high center of thrust imposed such a down load on the tail that the stick would have to be back in your belly all the time and if the stab. was set to correct this condition the ship would sit on her tail at any time the motor conked out. The worst thing was the down load on the tail resolving itself into a down moment against the lift to the extent of some twenty-seven pounds (the weight of one float on a twin job). Hard as it seemed to give the idea up it just had to be for the sake of our dispositions as there was an argument against it at every turn.

We weighed up the sesqui and found her wanting in a lot of things, even though she was a darling and a la Sikorsky. To make the 500-lb. mark we had to pare a lot of

(Continued on page 32)

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BLUE PRINTS for home builders. Northco Glider $3.00 set, turnbuckles $6.00, custom outfit $95.00, set metal fittings $29.50. Sport plane engine 50 H.P. $125.00, Airplane wire, turnbuckles, fitting complete $80. Altimeter, banking indicator $5.00, tachometer $10.00, two pts. Army war surplus $1.00, helmet $1.50. Aeroplane hub with flange suitable automobile engines $1.00. Steel tubing, plywood, plane, all builders' supplies. Booklet 5c. Marvin A. Northrop Aeroplane Company, 730 Washington Ave. No., Minneapolis, Minn.

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500 FORMULAS and Big Catalog 25c. Ideal Book Shop, DM, Park Ridge, Illinois.

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RUBBER STAMPS! 15c per line. DeLuxe Stamp Works, B572NS. Auburn, Nebr.

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NEW SPECIALTY—Sells every business. Four $15 sales daily pay $288 weekly. Worlds largest firms, Bell Telephone, Sears Roebuck, etc., use it. Smallest business needs it. Customer guaranteed cash return ten times price paid. Protected by $30,000,000 Surety Company. Repeats. No competition. Walker made $165 first day. F. E. Armstrong, Pres., 2019H, Mobile, Ala.

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ALBUM, 1,000 Hinges, 200 foreign, 25 Cuba, 25 Japan, 35c. Burtis Company, Saratoga, N. Y.

MALE HELP WANTED

STEAMSHIP Positions—Europe, Orient. Good pay; write for free list of positions. Drawer 292, Mount Vernon, New York.

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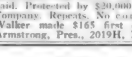
200 Different Stamps 10 cents; big price lists; 60% discount approvals. Covert Stamp, M39 State, Rochester, New York.

PENNY approvals, 5,000 Liberia, Nyassa, Congo, Sudan, etc. Also 14,000 averaging 15c. References. Philatelic Exchange, Huntington, W. Va.

Andy Continues Rabl's Letter

(Continued from page 28)



parts down to way below the stress factors that we had decided on and she was a wow of crazy little fittings and some handiwork that would have made a Philly lawyer stand on his ear.

Well, the gang threw up their hands in disgust and I went back to fundamentals and produced a ship that I feel right proud of. At the offstart I decided that there was a possibility of concentrating the main stress members around the framework of the float struts in a twin float job. That as the fuselage aft of the pilot's seat was not subjected to the landing forces of a land plane there was a possibility of even going to glider construction on these members, so we started in again on the stress analysis and weight figures. I had a rough tank test sheet on a pair of flat pontoons and with this as a basis we calculated the hump and take-off possibilities and were surprised to find that at the hump we required only in the neighborhood of five horse power to get her over. While this seems small our figures were checked and rechecked and we went to several other formulas and they proved pretty close. Of course, remember that this is the actual horses required and with the prop being pretty inefficient at this slow speed (16 m.p.h.) we needed only about twenty per cent efficiency to pull her over.

This little hack is the ship that I intend to develop and while I do not doubt that the baby Sikorsky will do her stuff with a Henderson I feel that the twin float job is the ideal machine for the amateur.

I hadn't exactly thought of writing it up when we started but if you feel that it fulfills the bill I have all the drawings made for our own construction and with some minor alterations (we are using such as some dural sections) it wouldn't take so long.

I was enthusiastic at first for the flying boat but now I honestly feel that the twin float jcb is the best one to tackle for the V-twin engines, anyway. And some day I may send you some photos of the ship if we ever get worked up to the building stage. I know that if you decide to publish the article that a ship will begin to take frame the day after the check arrives. I feel that it is up to America to develop the light flying boat as the nuts across the pond have developed the light plane.

Your'n again,

SAM.

THE old box is getting heavy, and I'll have to unburden a few choice morsels from fans who have long been waiting to see their names in this old sluice box of pied type; so—

Earl R. Floren writes: "—I have in mind using on my Lawrence water glider a two-cylinder Indian motorcycle engine, converted as shown in a back number. Kindly show how to put it onto the glider." That's about thirty bucks worth of engineering data, Earl. Can't you be lenient?

* * *

John H. T. Dow, of Hamilton, N. Y., writes me, "—I've just been reading your Mail Box column and must say you've some line-up for the next flying year book. Please let all the M-M fans know as soon as it is obtainable!"

Some line-up is right, Johnny. You can look for the biggest, thickest dollar's worth of plane plans ever published. It'll be on sale in October at any newsstand. Thanks for the boat pix.

(Continued on page 34)

$2.00

BRAND NEW

GENUINE *Model #3*

Lowest Price — Easiest Terms

HERE'S your chance to own that *brand new* Genuine Model 3 Corona you've wanted—on the easiest terms ever offered—at LOWEST PRICE ever offered. Complete in every detail; back spacer, etc. *Manufacturer's Guarantee.* Recognized the world over as the **finest, strongest, sturdiest portable built.**

S. Joveton writes: "It truly is a wonderful machine. I am very pleased with it and find it very simple to work although it is the first typewriter I have ever used."

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Mrs. G. Bernstein says: "Allow me to thank you for prompt delivery of the Corona. I am delighted with it and know I shall derive great pleasure from its possession."

Try this wonderful portable typewriter—the same machine that has satisfied 500,000 users. Experience the joy this personal writing portable typewriter can give you! Use it ten days free! See how easy it is to run and the splendidly typed letters it turns out. Ideal for the office-desk, home, traveling. Small, compact, light, convenient. Don't send out letters, manuscripts, reports, bills in poor handwriting when you can have this Corona at such a low price on such easy terms. Remember these are *brand new* machines right out of the Corona factory.

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If You Act Now!

Leatheroid carrying case, order, instructions free on this offer. Send no money—just the coupon. Without delay or red tape we will send you the Corona. Try it 10 days. If you decide to keep it, send us only $2—then $3 a month until our special price of $39.90 is paid. *Now* is the time to buy. Mail coupon today!

Save Money—Use this Coupon

Smith Typewriter Sales Corp., (Corona Division)
469 E. Ohio St., Chicago, Ill. Dept. 178

Ship me the Corona, F. O. B. Chicago. On arrival I'll deposit $2 with express agent. If I keep the machine, I'll send you $3 a month until the $37.90 balance of $39.90 price is paid; the title to remain with you until then. I am to have 10 days to try the typewriter. If I decide not to keep it, I will repack and return to express agent and get my money back. You are to give your standard guarantee.

Name .....

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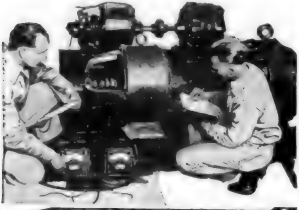
Learn Electricity IN LOS ANGELES



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NATIONAL is a Million Dollar institution—established in 1905—recognized throughout the electrical industry as one of America's foremost trade schools. NATIONAL offers practical, intensive training in all electrical branches. All technical essentials included. No age limit. No previous experience necessary. Life Scholarship privileges. Start any time of the year.

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Send me your big free illustrated catalog of Electrical Opportunities, explain how I can learn quickly and get a big-pay Electrical Job.

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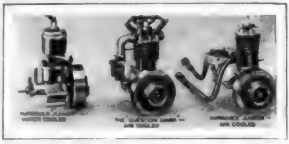
Age ..... City ..... State .....

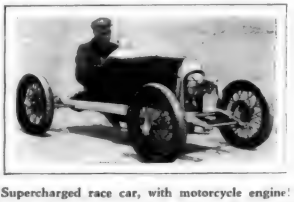
Eating Up Our SMB Letters

(Continued from page 32)



These little gas engines will do real work.

HI, CLOTILDE! What thinkee of the little coffee mills up yonder? Sweet little models, says I. Now if I had a spare dime I'd buy me one of these sets of castings, which the eds tell me come from Elmer Wall, and I'd make up an engine—marine enjine, mind yuh, and set her in a canoe and start on a polar exploration.



Supercharged race car, with motorcycle engine!

Of all the blithering idiots I'd nominate for oblivion at the same time I handed him a candy bar is the feller what sent me this snap shot above and neglected to tell me anything about it. She's a racer, and a little one. Y'can't quite make out that the engine is a v-twin motorcycle one though, but it is—the real photo shows it. Aside from that it has a supercharger out front, and—but that's all I do know!

"Spirit of the Backyard" built in Illinois

(Continued on page 36)

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The books you need! Thousands of dollars worth of UP-TO-DATE PRACTICAL information written by outstanding authorities, profusely illustrated with plates, diagrams, charts, etc. Simple, non-technical language. Let these practical books help you make more money. Which shall we send you? No risk, no obligation. Take advantage of our liberal 5-day Examination Offer—Mail order now.

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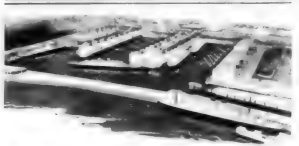
Andy Buzzes on Boats

(Continued from page 34)

Here's an Allegra model in nearly completed condition. A. B. Castle, Longville, Minn., owns her.

UP ABOVE is a pic of one of the Phil Rhodes-Westy Farmer designed *Allegra* models. She was built as an open boat. Incidentally—

Old John G. Hanna, leader of thought in the clan of practical boatbuilders, has been approached on a cruiser design for MODERN MECHANICS—a design that'll be all straight framework without any coives, a boat that'll go places and back under the urge of a Ford model T engine. And Jack will show how to convert a Lizzie engine for marine use. Jack has been telling the boys how to do things in the marine game for so long we look forward to his article eagerly. And as to modeling—lookout below:



How would you like to own a model basin like this one, full of real scale model ships? It was built by an anonymous M-M model fan. Neat?

(Continued on page 180)

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No Tricks or Stunts — You Learn From "Regular" Music

You don't have to know the first thing about music in order to begin. You learn to play from actual notes, just like the best musicians do. And almost before you realize your progress, you begin playing real tunes and melodies instead of just scales. There are no trick "numbers," no "memory stunts." When you finish the U. S. School of Music course, you can pick any piece of regular printed music and understand it! You'll be able to read music, popular and classic, and play it from the notes. You'll acquire a life-long ability to please your friends, amuse yourself, and if you like, make money (musicians are highly paid for their pleasant work).

Whether you like the piano, violin, 'cello, organ, saxophone, or any other instrument, you can now learn to play it in an amazingly short time. By means of this newly perfected method, reading and playing music is made almost as simple as reading aloud from a book. You simply can't go wrong. First, you are *told* how a thing is done, then a picture *shows* you how, then you do it yourself and *hear* it. No private teacher could make it any clearer. The lessons come to you by mail at regular intervals. They consist of complete printed instructions, diagrams, all the music you need, and music paper for writing out test exercises. And if anything comes up which is not *entirely plain*, you can write to your instructor and get a full, prompt, personal reply!

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Is America the Naval

by JAY EARLE MILLER

When the big guns roar again for the next war, will America discover that her navy has been made a second-rate one by the terms of the disarmament treaty recently executed by the "Big Five" powers? Mr. Miller tells here just what the treaty means to national defense in terms of battleships, cruisers, and big guns.

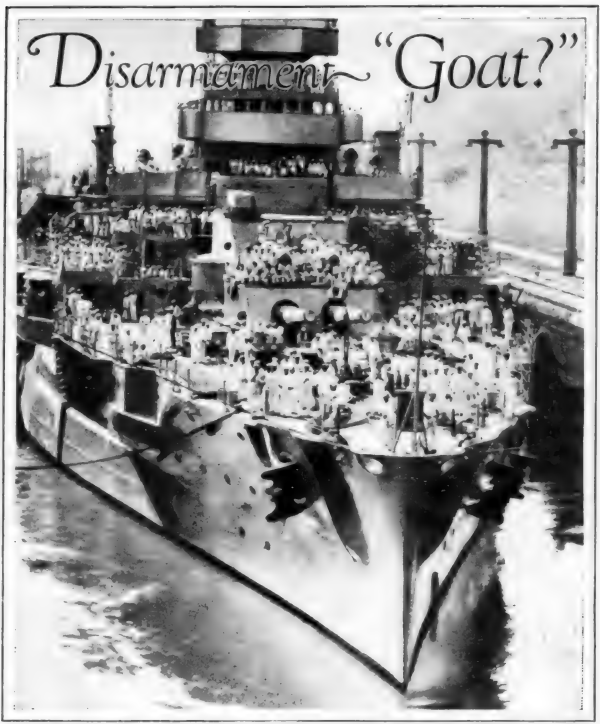
HAS the American navy, in the interest of future world peace, been permanently relegated to a secondary place on the seas? Did the delegation sent to London to bring home naval parity not only return with less than that, but actually sacrifice some of the present American strength under the Washington treaty, in favor of Japan?

Those two questions are expected during the next few months to produce as many words in Congress as the late tariff debates. The navy itself is divided on the question. Some admirals and other officers claim to be satisfied with the treaty, and others are outspoken in condemning it.

But, more interesting than whether Uncle Sam is to have a theoretical parity with England, and each major power is to have one and two-thirds the strength of Japan —the old 5-5-3 ratio laid down at Washington some years ago—is the problem of where the world's navies are headed, and what future war may be like when they get there.

The present tendency, as a result of the Washington treaty and the London agreements, is away from the battleship and the big battle cruiser. Since the completion of the British battle cruisers *Rodney* and *Hood* —the two most powerful warships afloat— no capital ships have been built, and, if the London pacts are approved, none will be built before December, 1936, when another conference is scheduled to consider the question again. If the present treaties are ratified, and another five or six year capital ship holiday should be declared in 1936, all the world's battleships would be obsolete before it expired, and it is doubtful that they would ever be replaced.

Strangely enough, the capital ship, which is designed solely to fight other warships, is giving way to the cruiser, which is chiefly useful either in guarding commerce routes



This U. S. battleship, the Arkansas, is one of three ships to be scrapped under the treaty terms.

or attacking commerce, a function which is at direct variance to the American doctrine of the freedom of the seas. With the limitations which are being put on submarines—the other great commerce raider—and on battleships, which are useful only in fleet action, the next war may see fleet scout cruisers scouring the ocean to raid and destroy enemy commerce or seize neutral ships bound for enemy ports in an effort on the part of the belligerents to starve each other out.

The apparent passing of the great armored sea-going forts only emphasizes the change that has taken place in the naval situation since the war. Under the 1916 and subsequent building programs the U. S. was destined to have the greatest navy in the world, and no other nation had the money to build to compete with us. Once built, the replacement program would not have

U. S. Capital Ships Outclassed in Speed by Those of Britain and Japan

Carrying ten 8-inch guns, the 10,000-ton U. S. cruiser Pensacola, is representative of the fleet warships with which navies of the world are replacing heavy battleships.

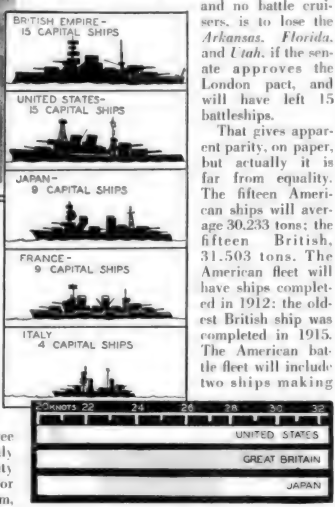
been burdensome, and it is doubtful whether any nation could have even threatened American supremacy in the next 50 years.

That advantage was voluntarily sacrificed by President Harding and Secretary of State Hughes when they initiated the Washington conference. They proposed parity between the British Empire and America, with Japan trailing behind in the ratio of three tons for our five, and France and Italy following with equal strength. The parity achieved, however, was on paper only, for President Coolidge's economy program, his hopes for further reductions at the Geneva conference, the reluctance of Congress to appropriate money, the activity of peace groups in fighting army and navy appropriations, and the action of both Coolidge and President Hoover in postponing construction which had been authorized, all worked to keep the U. S. navy below its authorized strength.

The result is that it will take sixteen 10,000 ton Washington treaty cruisers to bring the navy up to authorized strength in that division alone. Against England's twelve treaty cruisers, armed with 8-inch guns, and 40 light cruisers with 6-inch armament, we have two completed in the first class and ten in the second, while Japan, supposed to rate at three-fifths of our battle strength, has eight big cruisers and seventeen smaller ones.

Including her great battle cruisers, England has twenty capital ships, and is to sacrifice five of them, the *Tiger* and four vessels of the old *Iron Duke* class, leaving fifteen. The United States, with eighteen battleships and no battle cruisers, is to lose the *Arkansas*, *Florida*, and *Utah*, if the senate approves the London pact, and will have left 15 battleships.

That gives apparent parity, on paper, but actually it is far from equality. The fifteen American ships will average 30,233 tons; the fifteen British, 31,503 tons. The American fleet will have ships completed in 1912: the oldest British ship was completed in 1915. The American battle fleet will include two ships making



Number of battleships allotted the five powers, and relative speeds, shown in graphic form.

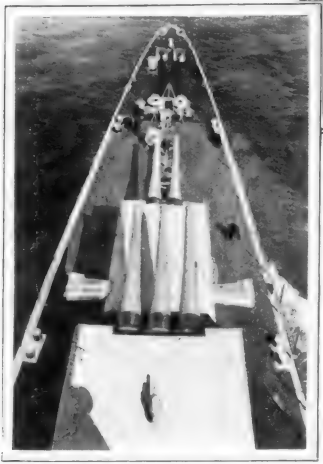
only 20.5 knots, and the other 13 make but 21 knots. The British fleet will include a 31 knot battle cruiser, two making 31.5 knots—the great *Hood* and *Rodney*—5 making 25 knots and 7 of 23 knots. In other words, the seven slowest can steam two knots faster than the best of the U. S. fleet.

Even Japan, limited to nine ships, will have nothing older than 1913, and nothing slower than 22.5 knots, while three of her newest battleships rate 27.5 knots.

And the older American ships mount 12-inch guns, while the English have nothing smaller than 15 inches and the Japanese nothing smaller than 14 inches. Added to that, several of our ships have not been modernized for high angle fire, while all the British fleet and most of the Japanese vessels can outrange us by several thousand yards.

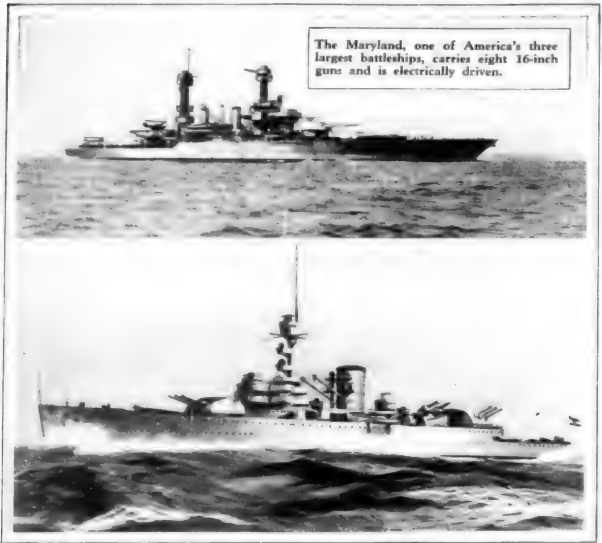
The London pact cancels the Washington treaty clause which would have permitted America to lay down four new battleships within the next two years to bring our battle fleet to parity with the British, while requiring us to scrap three ships we now have. Japan, on the other hand, is required to scrap but one vessel, the old *Hiyei*, which is obsolete and would have been scrapped anyway.

A vivid idea of the 32.5 knot speed of the U. S. S. Salt Lake City is conveyed by this unique-angle photo of the Navy's fastest cruiser taken during speed trials



Five of the ten 8-inch guns carried by the Salt Lake City, Uncle Sam's newest and fastest cruiser, commissioned last December.

Naval officers who object to the London pact center their protests, however, around the limitation on 10,000 ton, 8-inch gun cruisers, of which we will eventually have 18, if all those permitted are built. The American navy, they claim, needs this class chiefly to protect distant island possessions and scattered trade routes, far removed from naval bases. England, with naval stations in all her far-flung possessions,



The Maryland, one of America's three largest battleships, carries eight 16-inch guns and is electrically driven.

Unique among warships is the Ersatz-Preussen, German "pocket battleship," classified as a 10,000-ton cruiser, although its electrically welded, light alloy construction enables it to mount six 11-inch guns, eight 6-inch guns, and four anti-aircraft guns, in addition to six torpedo tubes.

can use the smaller 6-inch gun ships to advantage, and, in the London pact, the 6-inch gun idea prevails.

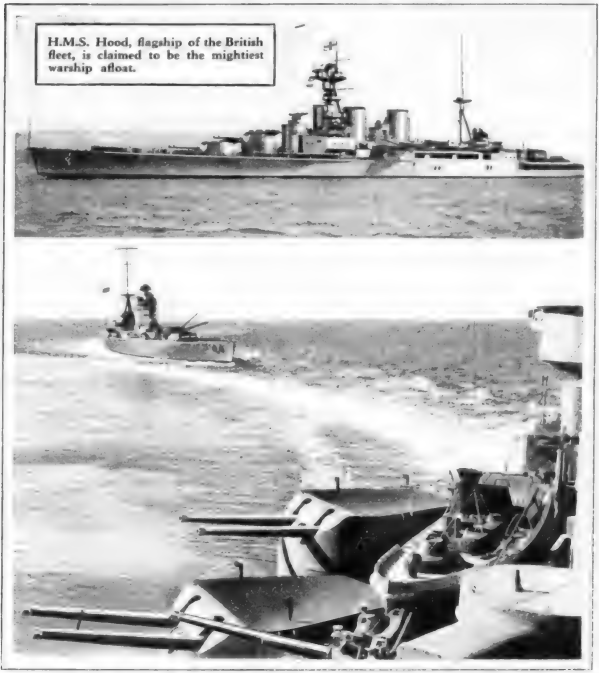
The 8-inch naval rifle will throw a greater weight of metal and explosive a greater distance with as great a degree of accuracy as a 6-inch gun. It was 8-inch guns that scored the majority of the hits at Santiago and sank Cevera's fleet.

Both the British Empire and the United States are to reduce their destroyer tonnage to 150,000, if the treaty is approved. England, with 134 destroyers, will lose little, but the United States, with 309—the greatest destroyer fleet in the world—will have to scrap about 100 of them.

With 122 submarines, against 64 for Japan and 53 for England, we again will be the biggest loser, for all three nations are to reduce to 52,700 tons. As most of the British subs are the small, coast defense type, she will keep about 30 boats, while to save our huge "V" class of 3,500 ton craft we will have quite a few less.

One result of the Washington conference has been the development of a class of so-called treaty cruisers with which no naval expert is altogether satisfied. A warship, experts agree, should have armor protection equivalent to its armament. If it carries 8-inch guns, its side and deck armor should be of sufficient thickness to protect it in a fight with ships similarly armed, fired at normal battle range and striking at the probable angle expected from that range, allowing for the rolling of the ship in a normal sea.

Great Britain Boasts World's Only Capital Ships Capable of 31.5 Knots



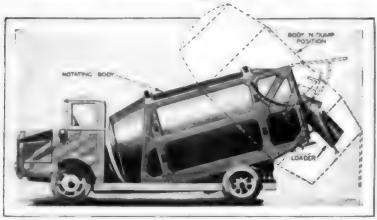
The Rodney, British sister-ship to the Hood, is one of the world's two battle cruisers capable of doing 31.5 knots—about 10 knots faster than the typical American ship of the same class. The Rodney is shown in the photo above trailing the Nelson, whose forward guns are shown to advantage.

Most of the treaty cruisers have sacrificed armor in favor of bigger guns, longer cruising radius and higher speed. The result is a ship which would be chiefly useful for attacking unarmed or lightly armed merchant vessels, again emphasizing commerce raiding instead of naval battle. In a fight between warships of equal armament the slower, but heavily armored vessel, will always have the advantage because it can stand up and take punishment while shooting its lightly armored opponent to pieces. The faster vessel can withdraw, it is true, and keep out of range, but it thereby defeats its one reason for being.

The idea that the best defensive was a powerful offensive, which is the basic thought behind the fast, over-gunned and under-armored ship, was exploded by the

(Continued on page 190)

This Self-Trimming Refuse Collector Bars Dust and Odor



Cans are placed on loader in rear and dumped with lever into slowly revolving tank which packs the load forward.

ONE of the long neglected divisions of motor transportation—the collection, conveying and dumping of municipal refuse—is now supplied with a special self-trimming refuse collector which is dustless, odorless and noiseless.

With this truck it will no longer be necessary for a man to stand on the unsanitary garbage or dusty ashes to trim the load, as the rotating body, inclined at an angle, automatically packs the load forward. Cans are placed on the loading device at the rear of the truck, and are dumped by merely lifting a lever.

For handling garbage and snow there is a dewatering device which will eliminate most of the fluid before the load is dumped.

Miniature House Forms Mail-Box

SHOWN in the illustration below is a private mail-box designed to represent a very handsome stucco house in miniature. As a model of a residence of quite elaborate architecture, it is planned with imitation windows and doors, chimneys, a walled *patio* enclosing the front entrance, and with all the other detailing common to a real home of the modified Spanish type, including even a portion that effects the appearance of being two stories in height. The walls, together with the dummy chimneys, are of light cream cement, and the roof, which is also made of cement, is so moulded and colored as to suggest red tiles. In a front wall, to substitute for a broad window of arched design, there is a combined slot and hinged door, painted black, for the receipt and removal of letter mail, and in the massive base on which the model house rests, on the far side, there is a door for receiving larger mail matter. The base is built of dressed stone, and is about three feet square by three feet high, the base and miniature house combining to produce a height of four feet four inches. The front of the base has a plate giving the owner's name. The home is located in Flintridge, California.

Racer From Old Seaplane Pontoon

New stern and cockpit were built into pontoon.

AROUND naval seaplane bases or civilian flying boat stations there are usually a few old pontoons to be found in the junk heap. If you can lay hands on one of them you can easily alter it to make yourself a hydroplane type of outboard motor boat, as shown above. You have to merely cut a few feet off the stern and build on a new one to accommodate the motor.

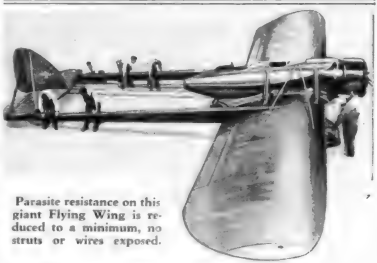
Giant Flying Wing Has Been Built for Eastern Pacific Hop

AN ATTEMPT will be made to span the Pacific this summer in one long hop of 5,000 miles by Charles F. Rocheville, a veteran pilot and the designer of this giant Flying Wing which has recently been completed by the Emsco Aircraft Corporation.

Before attempting the Pacific flight, Rocheville will endeavor to establish a new non-refueling endurance record, after which the plane will be shipped to Japan for the projected flight from Tokio to Seattle.

The Flying Wing which cost $50,000 to build has a wing span of sixty feet and a chord of nine feet with a wing curve designed to give maximum lift. The cockpits are arranged in a nacelle structure above the wing, there being no fuselage in the accepted usage of the word.

A Wasp engine of 450 horsepower is mounted at the forward end of the nacelle and a top speed of 150 miles an hour is expected. The plane has a gasoline capacity of 875 gallons, six tanks holding 300 gallons being built into the wings, while a tank holding 75 gallons is situated immediately in front of the forward cockpit.



Parasite resistance on this giant Flying Wing is reduced to a minimum, no struts or wires exposed.

Boy's Bicycle Gets Air-Minded

Wing and rudder are synchronized for steering.

HARRY T. NELSON, of Dallas, Texas, has designed a "Glide-O-Bike" for his son which provides a safe means of giving the boy a half-way feel of the air.

It consists of an ordinary bicycle to which is attached a set of wings and a tail. The lift on the wings and the down-pressure on the elevated tail combine to lift the front wheel when in forward motion, thus gliding the front end of the bicycle while the rear wheel remains on the ground for power. Wings and tail are quickly detachable for ordinary use of bicycle.

New Electric Tomato Pollinator

A NEW device of special interest to those who grow early tomatoes outdoors and greenhouse tomatoes indoors, has been recently placed on the market by the inventor. This little instrument, which resembles a revolver in shape but is not so heavy, very effectively and efficiently loosens pollen and causes it to come fogging out in a regular pollen cloud, even on damp, rainy days.

As most people know, bees do not care to operate on tomato blossoms. Greenhouses are nearly always humid and keep the pollen so sticky that it will not, of itself, loosen sufficiently to cause fertilization to take place. Growers have been forced to resort to hand methods which, at best, are slow and unsatisfactory in results. The inventor claims that his device lessens the amount of time and labor involved in the process of pollinating, and the result is large, symmetrical, marketable fruit. Tomatoes grown early in the season outdoors before nature provides warm, dry weather, usually lose the first blossoms entirely because the pollen fails to "fly freely." The pollinator saves the blossoms.

A wire hook, moved rapidly by an electric vibrator, loosens the tomato pollen.

KAYAK *Near* DISASTER

TO PROVE that his unsinkable kayak will be a satisfactory lifeboat for trans-ocean flights, Kai Pless-Schmidt recently made a nine-day ocean trip from Faroe Islands to Bergen, Norway. The trip almost ended in disaster only a few miles from its destination when it encountered a school of eight-ton whales.

The object of the trip was accomplished, however, for the mariner proved that an airman, after a crash at sea, might reach safety in this boat. The craft carries three persons and inside there is room for folding rubber boats which it could tow, and thus 32 persons could be accommodated in an emergency.

The boat was equipped with two outboard motors, both of which were lost when whales lifted the tiny craft out of the water. Sail and motor propel the kayak from ten to fifteen miles an hour, while it may be paddled about four m.p.h.

With outboard motor and sail the kayak made the 400-mile ocean voyage.

The waterproof lookout turret provides a view in all directions when closed. The kayak may be steered from inside.

Pless-Schmidt's departure from the Faroe Islands was the cause of celebration, the whole town of Thorshawn turning out. He got into difficulties immediately with the heavy seas around the island but conquered the head winds and currents with motor and sail.

When only a few miles from his goal the tiny craft almost met with disaster when he collided with a whale, causing him to ship a large amount of water. While attempting to bail the craft out he carelessly dropped overboard some aluminum boards. Immediately one of the greedy monsters jumped up through the

in BOUT with WHALE

Jumping from the water to seize some discarded floor plates, the whale almost demolished the craft.

water and swallowed the boards, grazing the side of the kayak.

To avoid being hit by the heavy body, Pless-Schmidt instinctively threw himself forward, smashing the glass skylight with his head. The whale, apparently cut by the plates in its throat, continued to jump out of the water, taking the outboard motor with it on one of its plunges. Stunned by the blow, Pless-Schmidt drifted helplessly for two days before being picked up by a passing ship.

300 Pound Racing Car Motor Streaks Off Record Speed

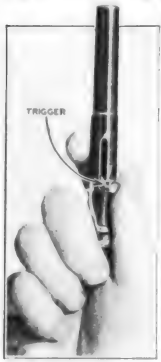
Bill White with his 300-pound aluminum racing motor which did 146 miles per hour on tests.

WHEN Bill White, the famous racing driver, unleashed the 198 horsepowers of energy contained in the 300 pounds of automobile engine shown in the photo at the left, he streaked along the tracks for a record of 146 miles per hour. The motor, especially constructed for White, was of the Schofield Special type, with four cylinders, and made almost entirely of aluminum, thus giving reduced weight.

Nineteen years ago Bob Burman set a mark of 141.74 miles per hour with his four cylinder engine, and White hoped to better it, doing at least 160. On the test, however, he was able to get only the 146, but he anticipates bettering even that in the supreme test at Indianapolis.

Simple Pen Shoots Tear Gas Bomb

A HIGHLY effective weapon of self defense—a tear gas gun that has the external appearance of a harmless fountain pen, is shown in the photo at the left. It fires a small gas cartridge which is inserted into the chamber by unscrewing the lower part of the pen. The firing pin is operated by pushing aside a knob with the thumb, which action releases the trigger spring and slight recoil is offset by holding the gun firmly in the hand. The gas is not deadly.



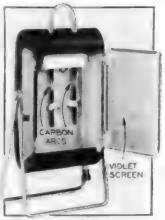
Insect Net Protects Fishermen

THERE are many things that bite for a fisherman besides fish, mosquitoes being the chief offenders. At the left is shown a head-net recently devised for the purpose of preventing the annoyance of insects. The net fits over the hat, is light in weight, and gives clear vision.

Insect net fits over hat.

Portable Health Lamp Like Camera

SINCE the advent of the sunshine lamp for toning up the system and giving vitality, lamps of many shapes have been put on the market, most of which were very bulky. In the photo at the right is shown a lamp which is both small and efficient, being not much larger than a camera. It can be transported easily and operates on any current.



This health lamp can be carried like a camera.

Williams Closes Navy Career With Death-Defying Feat

Inserts show "Al" Williams and the type of plane in which he recently performed the only aerial maneuver which had not been executed.

The diagram shows how the "inverted falling leaf" was accomplished. Flying upside down, Williams suddenly dropped a wing a trifle and the plane slid sideways and forward, gathering dizzy speed.

While the spectators gasped the ship paused a mere fraction of a second right on the verge of the fatal outside spin. Quickly the other wing was dropped and the ship began sliding to the other side. Back and forth Williams continued the maneuver, finally coming out with an inverted climb.

Magnets Create Organ and Horn-Like Tones on Piano

S. Cooper adjusting the "Crea-Tone" magnets.

PIPE organ and orchestra effects are now available for your baby grand, for Simon Cooper, of Brooklyn, N. Y., has recently perfected a device which may be attached to any piano to produce these tones.

The equipment consists of a series of electro-magnets, one for each string, in the form of little cylinders. The current is controlled through the pedal, which when depressed turns on the juice and causes sustained tones through electro-magnetism.

Stop-light Difficult to Ignore

THE unexpected bit of psychology that careless automobile drivers are less likely to run past a barrier consisting of an illuminated line across the street pavement than they are to ignore an ordinary red traffic light hung on a pole at one side is reported from recent tests in England with the method of stopping traffic by pavement markers.

The apparatus consists of a line of electric lamps buried underneath small glass lenses flush with the pavement or inside a glass-topped trough across the road. When traffic is to be stopped these lamps are illuminated, making a line of light across the roadway.

Colored Glass Keeps Out Flies

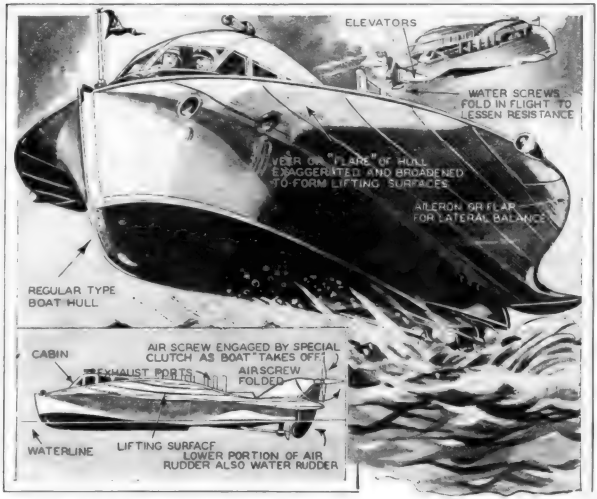
AN AVERSION of house flies to red or yellow light is attracting attention among British entomologists not only as a promising means of keeping flies away from food storerooms and similar places but probably as an example of the way that evolution has fitted the habits of these insects to the conditions of their environment.

Flies gather more numerously in the ordinary white light admitted by colorless windows. Blue and green glass made relatively little difference, the insects invading blue or green-lighted rooms in virtually the same numbers as were found in white-lighted rooms. Red and yellow glasses, however, attracted notably fewer insects.

Makes Neat Ice Spade or Chisel

OFTEN during the winter one needs a small light chisel or spade to loosen ice. A small bar drawn out wide enough is too sharp, and a heavier bar is too clumsy to handle though the end of it could be drawn out to suit the purpose. Take a piece of inch or inch and a quarter pipe, and with a hack-saw cut back the end of it along the seam for three or four inches. Heat it and turn the end out as shown. This will give a wide flat blade, not too sharp but just right for the purpose, though it can be sharpened.

Gar Wood Predicts Boats that Fly



Suggested lines of a speedboat which can fly as well as float are shown in this drawing of a double-purpose craft seen as a possibility of the future by Gar Wood, famous designer of racing boats.

MODERN speedboats show very little difference between the way they travel through the water and the way an airplane travels through the air. This is the observation of Gar Wood, noted designer of record-breaking speedboats, who recently remarked that he would not be greatly surprised to learn one of these days that boats are flying. A big thrill is in store for sportsmen when the time comes when one can own a boat and drive it about on the surface of the water, and then throw the engine into high, work the clutch on a propeller designed to get the craft into the air, and fly.

A speedboat, due to the step under the hull, is traveling almost in the air, or at least in a medium of spray and water that is largely bubbles. The veer or flare of a speedboat hull is in a measure a wing-like structure, helping to elevate the boat out of the water at high speeds. If the flare were exaggerated and broadened, as illustrated in the drawing above, it would be possible to lift the boat out of the water and maintain sustained flight in the air—provided, of course, that it was equipped with a propeller of sufficient size to provide forward movement.

What is now known as a "flying boat" is in reality an airplane that can float, not a boat that can fly. A real flying boat such as the one shown would be equipped with a water screw of special design so that it would fold up out of the way when the boat was flying, with a similar folding arrangement for the air propeller so that it would be out of the way when the boat was traveling on the water.

Charting the Air to Help

by **H. R. HILL**

Most aviation disasters have been the result of airmen's flying blindly into unforeseen storms and fogs. Out in California, however, aerographers are taking the guesswork out of aerial navigation. Read in this article how they chart air currents and weather conditions to guide airmen around these weather hazards.

MARK TWAIN once said, "Something ought to be done about the weather." No one has been able to do much about it, but in California there has been developed an amazing system for keeping informed on what the weather is throughout the state.

In the vast territory between Oakland and San Diego, where air transportation has been developed to a degree equalled nowhere else in the country, the necessity for instantaneous and accurate weather bulletins for air men has brought about the establishment of an intricate weather reporting system.

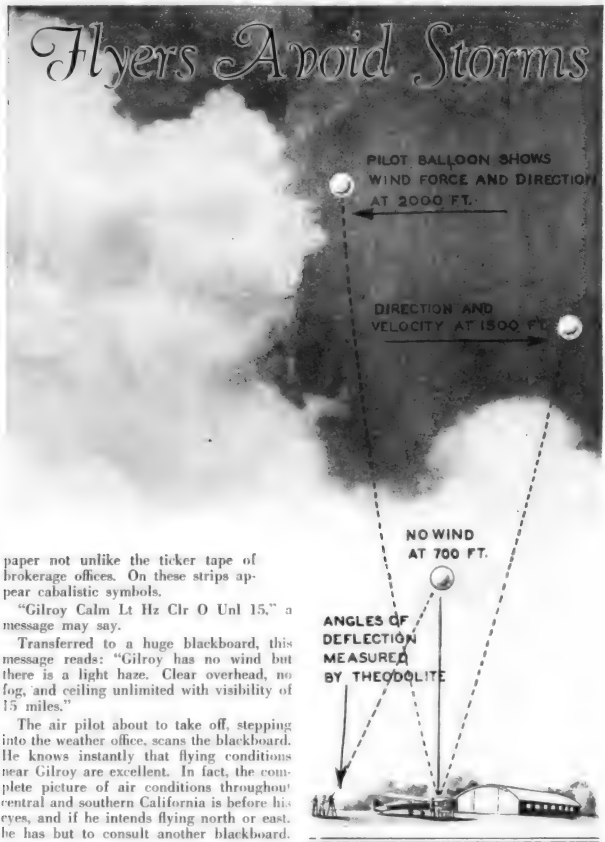
Embodying as it does every known device for supplying weather reports promptly, this system surpasses all others in the matter of "coverage," according to the United States weather bureau official in charge.

Telephone typewriters, called printers, are the main factors in this intricate system. The printer stations are at Oakland, Fresno, Bakersfield and Los Angeles airports. From these stations telephone reports of weather conditions are received from 33 intervening and outlying cities, including San Diego to the south, and Sacramento to the north.

In the weather bureau at Oakland municipal airport, beginning at 6:30 a. m. and continuing at 90 minute intervals throughout the day, the reports pour in.

"Click, click—click, click, click—click," sings the typewriter. From a narrow slot on the side of the machine comes a strip of

Flyers Avoid Storms



paper not unlike the ticker tape of brokerage offices. On these strips appear cabalistic symbols.

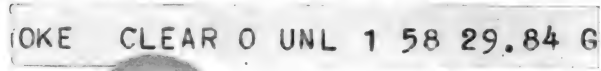
"Gilroy Calm Lt Hz Clr O Unl 15," a message may say.

Transferred to a huge blackboard, this message reads: "Gilroy has no wind but there is a light haze. Clear overhead, no fog, and ceiling unlimited with visibility of 15 miles."

The air pilot about to take off, stepping into the weather office, scans the blackboard. He knows instantly that flying conditions near Gilroy are excellent. In fact, the complete picture of air conditions throughout central and southern California is before his eyes, and if he intends flying north or east, he has but to consult another blackboard.

Meanwhile, another operator in the Oakland office has been busily engaged in collecting by telephone weather reports from cities in his territory. These in turn are

To measure upper air currents at various level the movements of a small captive pilot balloon are traced by a theodolite observer, as shown above. Findings become part of weather data.



Above is a typical strip of tape with the code transmitted by the telegraph-printer.

The small pilot balloon is inflated with hydrogen and carefully weighed for the observations.

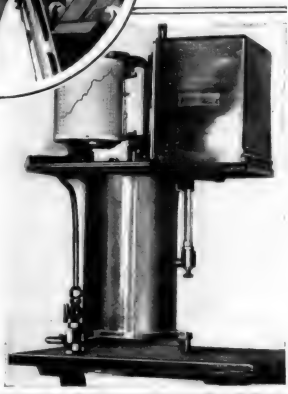
The observer above is tracing the pilot balloon's movements with a theodolite.

flashed over the wires and appear as cabalistic symbols in the other printer offices of the network. Should a pilot in Los Angeles desire more detailed reports of certain areas these are requested and within a very few minutes given.

The telephone typewriter is the most important electro-mechanical element in this new weather reporting system. It can be operated by anyone who can operate an ordinary office typewriter. It is instantaneous. To press a key in one office means to record a letter in another office perhaps 500 miles away. Operators may talk back and forth if they wish, and often do. Trained meteorologists are required only in the actual observation of sky conditions.

At each of the observation fields the direction and velocity of currents of the upper air are measured by pilot balloons. Every 90 minutes the observer releases the inflated balloon on the end of a cord and stands by at the eyepiece of his theodolite as the balloon ascends. With the extremely delicate thumb-nut adjustments he follows the movements of the balloon, taking his readings when the buzzer attached to his instruments sounds the proper moments. Determining the balloon's altitude becomes a mathematical process based upon the time the balloon has been in the air.

The efficiency of pilot balloons has been greatly increased by the use of balloons offering maximum visibility under existing weather conditions. Balloons of black rubber are used for observation just before sunrise or after sunset. White balloons are used during hours of bright sunlight, and red ones when there is fog or low clouds.

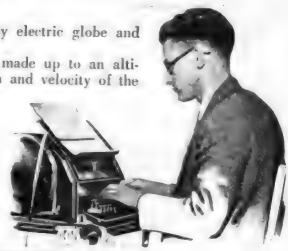


The direction and velocity of the wind close to the ground is measured by an anemometer and vane atop the observation station and transmitted to the weather office, where the data is recorded on an anemograph, shown above.

ILROY CALM LT HZ CLR .O UNL 15

Night observations are made by fitting a tiny electric globe and battery to each balloon.

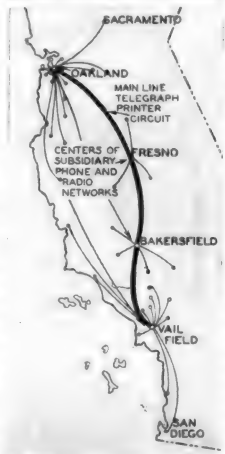
Pilot balloon observations are frequently made up to an altitude of 35,000 and 40,000 feet. The direction and velocity of the winds at various levels is accurately determined. After a pilot balloon run has been made the aerographer steps back into his office and transmits his findings throughout the network of observation stations, at the same time receiving their observation reports. By the coordination of his data he can tell an aviator where and at what altitude he must fly to take advantage of tailwinds and avoid storms and fogs. The aviator then lays out his course accordingly.



The heart of the communication system is this telephone-typewriter which flashes weather reports from one station to another.

Another new development of the department of commerce, a device for measuring the height of the ceiling at night, is playing a prominent part in the night reports. On the roof of a hangar stands a powerful beam light which is turned upward at a given angle. From this angle it never deviates. On the roof of the weather bureau 500 feet away is another light with a "sighting board" marked with the figures 100 to 3000 upon which is fixed a movable arrow.

The light beam from the weather station roof strikes the ceiling and there creates a bright spot, much as does an automobile headlight in striking the side of a building. The operator sights the arrow on the spot. Then he reads the mark nearest the arrow. This gives him the height of the ceiling. In other words, the answer to a problem in triangulation has been given him. Simplicity itself is this method, perhaps so simple that no one thought of using it until recently. Today, a ten-year-old boy can report accurately the height of cloud or fog bank by merely pointing the arrow at the spot made by the beam of light.

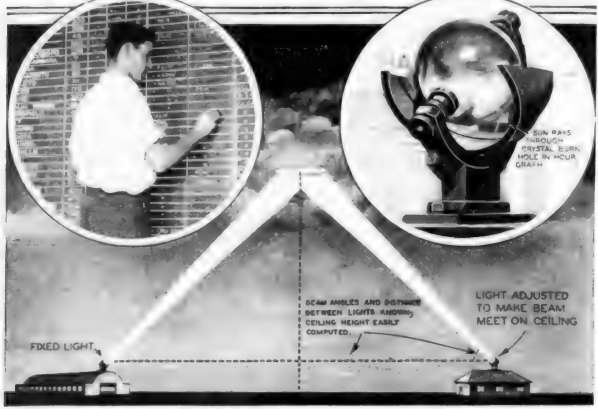


Weather station network, with the central collecting points and subsidiary stations, where data is gathered.

Combined with these instruments in the task of informing airmen of conditions above the earth, are the anemograph, an instrument which records wind velocity and direction at the surface, the barometer and all the usual equipment of a United States weather bureau. By means of the low wave radio, the transcontinental line is kept informed of conditions eastward of California.

Nine commercial air transport companies are now depending upon this weather report service. In addition, hundreds of non-commercial pilots scan the blackboards daily before taking off in their respective cities, and each may have,

Air Pilots Can Lay Out Safest Course From Weather Station Bulletins



At night the ceiling height is measured by bringing two searchlight beams to a bright intersecting point on the under side of the clouds. The height is computed from the angles of the beams and the distance between the lights. Left insert: Weather report being chalked up on the aviation field bulletin board for pilots about to take off. Right insert: The sunshine recorder which registers the hours of the day when the sun is out. The sun's rays are focused on a graph through the crystal.

if he so desires, a detailed report to carry with him.

But even with this elaborate service, the federal bureau and the Guggenheim Fund are not satisfied. Each recognizes that it is pioneering a new field. Hence new devices are constantly being tried out, and the latest of these will be a "block signal" system.

The pilot nearing the airport of his destination will look for certain towers on the tops of which will appear movable markers. These markers will be operated from the nearest airport. In one position they will mean fog ahead, in another, head winds, and so forth. He will be guided much the same as is the railroad engineer watching his own tried and proven block signals.

The value of this superior weather science to aviation has been fully demonstrated. By furnishing the aviator with wind and weather information, which is figuratively "right off the griddle," airplanes now avoid an endless number of weather conditions that were formerly sources of danger and lowered efficiency of service.

The days of aviators flying blindly into headwinds, fogs, rains, snowstorms, and regions of wholly obscured visibility are gone forever. A commercial airplane route is no longer the shortest air line between two points of earth contact. It may be anything within a hundred miles or more to one side or the other of an air line course across the map, depending entirely upon the weather conditions. With the advantages of speed and unlimited mobility as to route, the increased distance is nothing compared with the advantages gained by flying around weather obstructions and with the winds instead of against them.

The records thus far compiled by the experimental aerological service in California have revealed that there is scarcely a time that the whole state is a solid mass of

(Continued on page 202)

RARE ECLIPSE *Photographed*

A RARE eclipse of the sun by the moon—rare because the band of total darkness was not more than half a mile wide, and, moving at 1600 miles an hour, lasted less than a second—swept a thousand mile pencil point of black across the northwest on April 28, while dozens of astronomers on the ground and in airplanes sought to trap it on photographic plates.

The eclipse was unusual in that it came so near missing the earth entirely, and therefore was so small that even a mile deep mountain valley on the moon, swinging into position on the edge of the moon's disc at the wrong time would have been sufficient to defeat the astronomers and let rays of sunshine past.

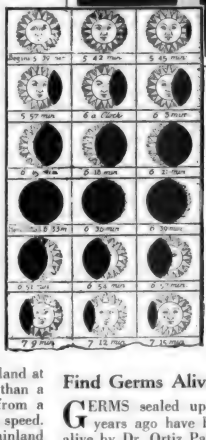
The width of eclipse shadows vary greatly, depending on the distance of the moon from the earth. The band of total darkness may range from several miles in width, when the moon is nearest the earth, down to a pencil point of blackness, and, with a few more miles distance between world and satellite, the pencil point ends somewhere out in space and the result is only a partial eclipse.

Eclipses with fairly wide bands of darkness are much the more common, and present no great problem for the astronomer, not only because it is easier to locate within the wider band, but because the duration is equal to the width, and therefore there is more time to take pictures. Eclipses lasting from a minute up to more than four minutes are much more common than total eclipses lasting only a second, as the April one did.

From an airplane the circular shadow of totality, racing across the land at 1600 miles an hour, was no larger than a small cloud shadow, and differed from a cloud little except for its tremendous speed. The shadow first touched the mainland north of San Francisco, and eventually disappeared near the Montana state line, about 1,000 miles inland.

While an eclipse today is taken for granted by the entire civilized world as a scientific phenomenon, a century ago such an event was clouded by superstition.

Above is shown Albert J. Brooks of the Brooklyn Institute of Arts and Sciences showing pupils how the recent eclipse looked when reflected on cardboard.



At the left is a reproduction of a seventeenth century newspaper account of a total eclipse. The story accompanying this drawing referred to the eclipse as a "terrific, ominous and portentous event."

Find Germs Alive After 26 Years

GERMS sealed up in culture tubes 26 years ago have been found to be still alive by Dr. Ortiz Patto. Having a number of these culture tubes made up as long ago as 1903, he inoculated samples into living animals to see if typical diseases would be produced. Many of the germs grew in the new cultures and some produced disease just as these same germs would have done when young.

"PUTT-PUTT" Takes

The Bob-o-link course at night.

The ancient and honorable game of golf has gone Scotch with a vengeance. Long a pastime requiring broad acres, expensive club-houses and equipment, the game has now moved into the city within access of all — and it costs only a quarter.

Above is a comprehensive view of the Bob-o-link Miniature Golf Links introduced in Los Angeles by George R. Gillespie. At the left Ruth Roland, former motion picture star, tees off.

MINIATURE golf courses, which are on the increase in several states, are now being equipped for night golf through a new system of illumination and the game, played under flood lights, is becoming a country-wide craze.

At least a score of such installations have recently been made on the best known courses at

COUNTRY *by* STORM

Above is the same Bob-o-link course as it appears in daytime, proving that "old Sol" finally has found a rival.

The eighteenth green surrounded by realistic bunkers.

specially selected locations in large cities. The illumination necessary on the average sized miniature course is provided by eighteen 500-watt floodlights.

The new game is perfect both from a golfer's standpoint and from the view of a complete novice seeking exercise and recreation. The Bob-o-link miniature Golf Links in the Wilshire district of Los Angeles is an eighteen hole course laid out and constructed by an experienced golf architect, has 20,000 square feet of putting greens and is 70,000 square feet over all.

The putting greens surrounding each hole are of a composition substance resembling smooth asphalt and are of ten inch thickness. The fairways of green grass are short, to be sure, but are so arranged with difficult hazards that the course requires careful and accurate shooting. Hazards are of all shapes and sizes and include sand traps, logs, mounds, ditches, tiny streams, hurdles, arches. The course is a real test of golf. When one has completed the game he will have walked more than one fourth mile.

Four thousand watt lamps situated in each of the four corners of the course keep the links well lighted for night playing.

The golf shop and clubhouse is completely equipped with clubs and balls of regulation golf links size. There are instructors for class and individual lessons. In fact, every convenience offered in a large golf club has been provided.

George R. "Big Boy" Gillespie is general manager and part owner of the miniature links. His wife, the former Catherine Thorne of Chicago, is assisting her husband as cashier.

Restoring YOUTH to

Note the massive spars of the redoubtable "Constitution."

By F. N. Hollingsworth

Having attained the age of 133 years, the most famous battleship of the American Navy, the frigate Constitution, better known as "Old Ironsides," has just had her face lifted, figuratively speaking, and within a few weeks she will be just as good a fighting ship as on that famous day when she defeated the Guerriere.

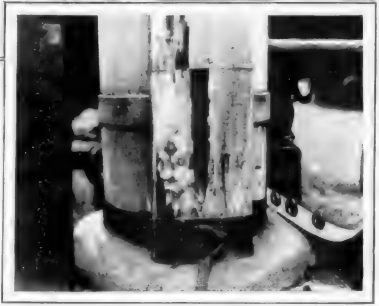
SAVED once from destruction by the words of a poet who aroused the nation to indignation over the proposed breaking up of the ship, the famous old frigate *Constitution*, better known to all Americans as "Old Ironsides," has once again waged a successful fight for her right to live. This time the enemy was the insidious forces of decay which were rotting away the wooden members of the hull and in general making the ship look as if every one of her 133 years of life had been hard ones.

Through the pennies of American school children, contributed to finance the job of restoring her youth to Old Ironsides, the frigate which the British described as "a bundle of boards sailing under a bit of striped bunting"—but which later proved formidable enough to vanquish the crack warships of the English in the War of 1812—is emerging once more from the dry docks in as good condition as when she was first launched. The refitted *Constitution* will be one of the stellar attractions during the statewide celebration of the Tercentenary of the Massachusetts Bay Colony, at which ten million visitors are expected this year.

Old Ironsides, of course, was not ironsided at all—the first armor plated ships were the *Monitor* and *Merrimac* of Civil War days. The *Constitution* won her affectionate nickname from the men who manned her and the country which applauded her exploits, by her ability to flip enemy cannon balls from her hardwood sides with the whole-hearted abandon of a dog shak-

"Old Ironsides"

Old Ironsides in drydock at the Charlestown Navy Yard. Photo shows the work of repairing and painting the hull almost completed.



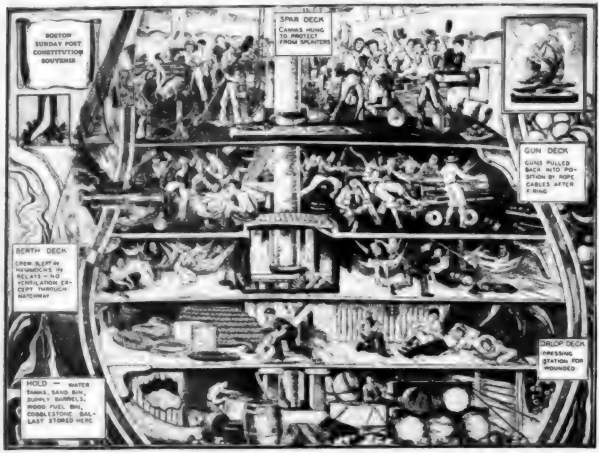
Showing decay at the foot of the 133-year-old mainmast.

ing water from himself after a dip in a lake.

Already some 710,000 board feet of lumber, live-oak, white oak and long leaf yellow pine, enough to construct 47 six-room dwellings, has been used in the reconstruction. This timber had lain under water in a Florida lake for 49 years. Besides, there will be used 110,000 feet of the finest grade Douglas fir, donated by an Oregon lumber firm, for the masts and spars. The *Constitution* had abnormally long bowsprit and exceptionally tall masts, that gave her an enormous sail spread and made her so fast and quick in battle maneuvers!

Built and launched at Boston in 1797 as a frigate of 1576 tons, with a rated armament of 44 guns, but actually carrying 52, she had just returned from a foreign cruise under Captain Isaac Hull when the War of 1812 was declared. She sailed from Annapolis July 12th on a cruise northward, but was caught in a calm July 17th, when she began one of the most remarkable naval retreats ever recorded. Unable to cope with a strong British squadron, she had to flee. Her boats were launched and manned with sweeps; a long 18-pound gun was rigged as a stern chaser and another on the forecastle; two 24-pounders were run out of cabin windows and all light can-

Cross-Section of Old Ironsides Shows How the Ship Looked in Action



This print gives a good idea of the interior arrangements of Old Ironsides and shows what went on below decks when the fighting ship was in action. Drawing is reprinted by courtesy of the Boston Post. Note that everything is designed for practical efficiency, with no room for unnecessary luxuries.

vas set. Calm and breezes succeeded each other, while alternate kedging and sailing kept her moving, to puzzle her pursuers, who at length discovered the method and did the same. All day and all night Hull's expert seamanship kept the distance too great for gunfire. At midnight, after 64 hours, the British gave up the chase.

August 12th she again sailed from Boston with a crew of 470 men and boys in search of the *Guerriere,* one of her pursuers, a 38-gun frigate. Captain Hull was eager to avenge the insults of the British newspapers.

Hull finally fell in with the *Guerriere* and withheld his fire until the vessels were very close together. Then the *Constitution's* guns, double shotted, with round and grape, did terrible execution at pistol shot range. In fifteen minutes the *Guerriere's* mizzenmast was shot away, the main yard in slings, her hull, spars, rigging and sails torn to pieces. The *Constitution* now rammed with her bowsprit on the port quarter and both tried boarding. The *Guerriere's* flag was shot away and she was unable to signal surrender. She was taken, but was so badly battered that her crew was removed and she was set afire. The *Guerriere* lost 70 killed and wounded and Hull only seven.

On his return he was accorded highest honors by Boston and New York, and Congress voted $50,000 prize money to the crew. Hull then retired to give other officers a chance, and was succeeded by Captain William Bainbridge, who fought a furious battle with the British frigate *Java.* 49 guns. Her wheel was shot away, but Bainbridge managed his vessel with such consummate skill that she was first coming into the wind, and able to shoot away the *Java's* jib-boom and the head of the bowsprit. Then she raked a broadside into the *Java's* stern, followed by another which brought down the foremast, crushing the

These guns of Old Ironsides fired a 12-pound cannon ball. It was a broadside from these guns that reduced the proud British Guerriere to a helpless hulk. Ropes were used to haul the guns back into position after the firing recoil.

Decay of interior planking alongside one of the gun ports.

forecastle and main deck. When the *Java's* mizzenmast was shot away, she surrendered. Bainbridge blew up the *Java* and paroled his 500 prisoners in San Salvador. Like Hull, he was signally honored and $50,000 more prize money came to the crew from Congress.

Under Captain Charles Stewart she next captured a war schooner and a privateer, was chased into Marblehead, and in December, 1814, captured the British frigate, *Cyane*, 36 guns, 180 men, with, a few hours later, the *Levant*,18 guns. Shortly after she was chased by a British squadron, but escaped with the *Cyane* as a prize. The *Levant* was recaptured in the harbor of Porto Praya. Captain Stewart received equal honors with Hull and Bainbridge on his return to America. This was the last fighting cruise of Old Ironsides.

Many years afterward the Navy Department decided to break up and sell the ship, but public opposition was so strong that she was saved and converted into a schoolship, which was commanded by the late Admiral Dewey for a while. She was finally decommissioned, and since 1897 has lain at the Charlestown Navy Yard, at dock, where she was an object of veneration until 1927, when she was found to be in such condition that she had to be completely restored, or fall apart in some severe storm.

Week-End Camping Trips by Plane Becoming Popular

A small shelter tent such as the one shown here will fold up into a bundle easily stowed away.

WITH the great open spaces steadily becoming farther and farther from the cities, swifter modes of transportation have become necessary for week-end campers. The light plane, which may be safely landed on any reasonably level field or beach, has done much to solve this problem.

Sportsmen may now take off from New York and spend the week-end in the New England hills with a loss of only an hour or two going and coming. Collapsible fishing rods, pots, pans, and a few provisions are easily stored in the plane.

Radio Waves Don't Harm Man

SIR George Filmer, a private scientific experimenter of Toronto, has recently caused considerable discussion by claiming that several sudden deaths occurring to patients under anesthetic in Canadian operating rooms might be due to "electrolysis" caused by powerful radio waves acting through ether vapor in the patient's lungs.

One answer to such agitations is always forgotten by the agitators; the fact that radio waves more powerful than any used by man are broadcast regularly by thousands of thunderstorms. If radio waves could harm mankind the race ought to have been exterminated millions of years ago by thunderstorm static.

Records Average Speed of Autos

BELIEVING that there is a market for such an instrument, an English inventor has produced a speedometer which registers the average speed of the journey. The instrument is worked by clock work and may be wound or set at zero by a knob on the front. It registers average speeds up to 55 m.p.h. for journeys up to 320 miles, although no damage will be done to the instrument should that distance be exceeded before resetting.

Dustproof Cover Protects Clothes

THE "Dresvelope," a patented covered clothes hanger which has recently found its way to department store counters, is designed to protect garments and keep them in condition for storage, packing or carrying.

Dresvelope may be folded for carrying garment.

Train Passengers May Talk Over Radio to Distant Friends

TELEPHONE connections have been established with ships far out at sea, with high flying airplanes, with distant continents, and now fast moving passenger trains come in for their share of the accommodations afforded by radio telephone. The practicality of radiophones for passenger trains was proved in the successful two-way communications recently held between passengers of the Chicago-to-Montreal Canadian National train and their friends at various points scattered throughout the United States and Canada.

The train was filled with road officials, scientists, and newspaper men out to witness this first train-to-land radio communication ever held. In making the tests, they were allowed to talk to their friends and relatives at any point in the continent. One man talked with his wife in Texas, newspaper men talked with the city editors of their papers, and one man actually conversed with his friend in London.

Calls were put in in the same manner that any ordinary long distance call is put in over a telephone, and in a short while the two parties were connected. The voice signals of the passengers were flashed from an antenna rigged up on the roof of the coach, as shown in the photo at the right, to the telegraph wires running parallel to the tracks, about thirty feet away. Thence the signals were carried to a distributing station.

Above: The Radio Telephone antenna installation aboard the Canadian Nationals train. Below: Official pointing out radiophone generator.

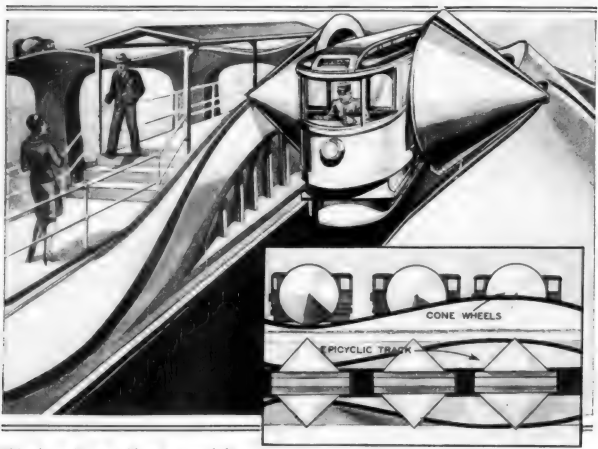
Sixteen-foot Sailboat Carries Athenian Home in Modern Odyssey

SOMETHING of the spirit of the adventurous mariners of ancient Greece must have entered on the blood of Nicholas Gangapolos, the Greek who is soon to set out in his 16-foot sailboat to make a lone exodus back to his native Greece. Seeking to emulate the achievements of his distant forbears, Jason and Ulysses, he will set sail very soon from Miami, and his first port of call will be Athens.

His voyage will take him across the Atlantic, down through the Pillars of Hercules and into the blue Mediterranean, and finally up into the classic waters of the Aegean. He will sail alone, in the manner of the ancients, doing his own navigating, steering, and cooking. He will carry food supplies enough to last him for three months.

The sixteen-foot "Ulysses" in which George Gangapolos, shown in the insert, will sail to his native town of Athens.

Can Trains be Run



This shows how an idea propounded a hundred years ago for the propulsion of railroad trains might look as applied to a modern railway. Cones that run up or downhill by gravity are the underlying principle.

by HJALMAR LUERSSEN

OF ALL the mechanical brain-bugs that repeatedly surge over the country, the perpetual motion bug holds all records for depth and duration of sting. The perpetual motion idea has been recurring in cycles and minor cycles for over a thousand years, or since the birth of scientific thought, and magazine editors have recently noted that the virus has again affected inventors.

Thus it is we have at present a wave of all manner of hare-brained schemes for extracting power from nothing. Among these schemes is a fantastic idea for running a train over an epicyclic track, using cones attached to the sides of cars instead of the regular flanged railroad wheels. Gravity is supposed to furnish the power and keep the train running on the level.

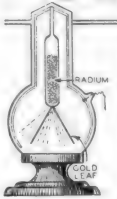
Will it work? Will gravity run such a railway?

Let us see. Let us revert to a familiar form of illusion called the "cone and track" experiment, familiar to all students of high school physics. In this device a cone will appear to roll uphill when placed on a track which runs uphill and diverges outward. The coned wheel will move toward the high point on the track and the tips of the cones will be resting at the highest point on the track when your hand brings it to rest.

In reality, however, the center of gravity of the cone fetches up at the end of the track in a lowered position. Hence the cone really runs downhill while appearing to run uphill.

by Perpetual Motion?

The fallacies surrounding many ideas in perpetual motion are set forth in this interesting yarn which recounts some of the impossibilities suggested to solve the age old problem of getting power from nothing. Wheels with over-balance, sponge engines, gold leaf machines, and a railroad which appears as though it might actually work are recounted.



Leonardo da Vinci, one of the greatest minds of all time, gave up the idea of designing a wheel with over-balance, realizing power can't be had perpetually. Perpetual motion schemes such as the one utilizing accumulating and discharging electrical particles through radioactivity are not true perpetual motion machines.

And looking into the annals of perpetual motion history, we see that over a hundred years ago one Jaime de Bonheur proposed the building of such a railroad. Not lacking in ambition, he. His idea encompassed and envisioned a railroad of this order built around the world! The subject of this idea has been treated very cleverly by Stewart Rouse, nationally prominent cover artist, in this month's MODERN MECHANICS. Of course, for reasons just mentioned, it will not work unless the whole path of the train was continually downhill. It would not run on the level any farther than from the bottom to the top of one of the track humps.

This subject is a fascinating one.

Plenty of men have gone crazy trying to solve the riddle of perpetual motion. Plenty more will go dotty as time goes on — that's a sure-fire bet. Even the artist, Leonardo da Vinci, the greatest mind of his time, could not withstand the temptation to present to the world a perpetual motion scheme. He designed a wheel on the oft invoked principle of over-balance but soon came to the conclusion that he was pursuing a phantom. The idea of permanent over-balance, as an endless source of power as contradicting as it appears returns constantly as a principle of eternal motion.

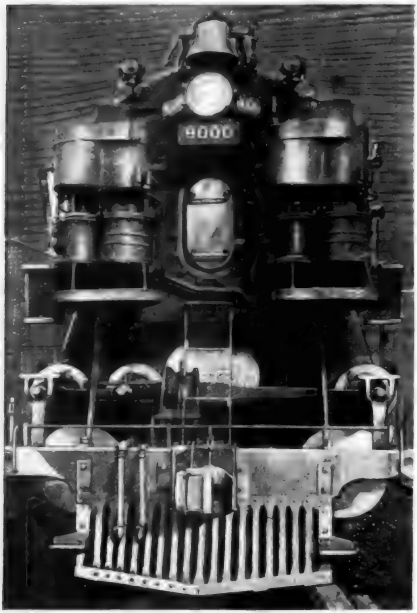
This shows the reason the gravity railway will not work. Although the cone appears to run uphill, and most certainly would seem to be willing to coast down—it won't! The drawing explains.

During the year 1640, the Marquis of Worcester announced the production of a wheel, which was to be kept in constant motion through swinging weights. The test took place in the presence of King Charles I and his entire court in the Tower of London. Nothing is recorded regarding the success of the demonstration, at any rate the invention has sunk into oblivion which in itself would indicate that the wheel of the Marquis of Worcester did not run eternally.

In former times, patent offices were not quite as rigorous. In England alone, more than 600 patent rights were granted on per-

(Continued on page 204)

BIGGER and BETTER



Note the third steam cylinder under the boiler of this 9000 type Union Pacific locomotive. Most locos have but two cylinders.

Locomotive design is getting more intricate every year as the railroads improve on the breed of their iron horses. Details of some of the latest developments in design, which include giant locomotives a third of a block in length, are interestingly set forth in this authoritative article.

Locomotive design is getting more intricate every year. The Germans, who have been going in for steam turbines instead of the old style reciprocating engines, have several types that eat their own smoke and drink steam.

Up in Canada the government owned Canadian National lines are experimenting with huge Diesel-electric engines which have most of the advantages of an electrified railway, without the expense of overhead wires.

An American road has an order in for a round dozen giants that will measure, when the last one is completed this year and the twelve are lined up end to end, just five city blocks over all, or 125 feet for each locomotive.

A "HUSH HUSH" locomotive, surrounded during its construction by the utmost secrecy, recently made its trial run in England, and won the season's palm for the weirdest thing traveling on wheels. It has a mouth in front to inhale fresh air, which is warmed by the boiler and fed to the fire while super-heated, and, like most English designs, the "works" are almost completely hidden under a smooth outer shield designed to cut down wind resistance.

The new English "hush hush" engine has the first locomotive water tube boiler used in England, and operates at a working steam pressure of 450 pounds. The trend in every country is toward higher steam pressures. The English engine, which was built for the London and North Eastern Railways, has four steam drums below the boiler and in front of the fire box to collect the steam

Iron HORSES

by ROY DEAN

from the water tubes, and deliver it in turn to the main steam drum above the boiler. Cold air is drawn in through an orifice just above the frame in top, carried back around the boiler, and down along the rear of the fire box into the ash pan, from which the hot air is fed upward through the fire.

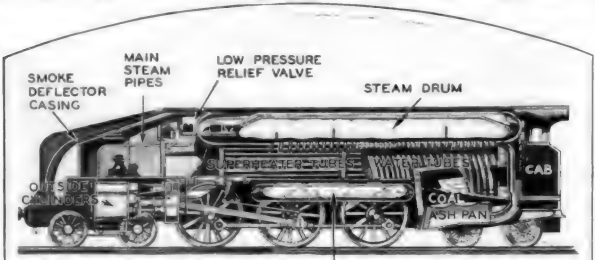
The short, stubby smoke stack is streamlined at the the back to reduce wind resistance, and on either side curious flanges in the outer casing of the boiler lead upward to deflect smoke and steam up into the air, instead of allowing it to swirl back along the locomotive and blind the engineer in the cab.

Most types of locomotives in this country have names, such as Mallets, Pacifics, etc., but to engineers and railroad men in general they are always classed according to their wheel arrangements. The new Northern Pacific 5,000 Class, a dozen of which have been ordered for heavy freight service on the Glendive, Mont., to Mandan, N. D., division, are 2-8-8-4 type, for they have sixteen drive wheels between the pony and trailer trucks, arranged in two groups of eight each, each group being driven by a pair of cylinders supplied with steam at 250 pounds pressure and 240 degrees superheat.

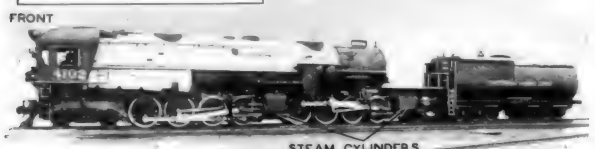
Lowering an oil-burning Diesel motor into a Canadian National locomotive. This motor runs an electric generator to supply current.

They were designed for a special job, burning low grade, semi-bituminous coal, obtained from a nearby mine, and because of the low heating value of the fuel required extra large fire boxes, 114 inches wide and 266 inches long, the largest ever used in a locomotive.

As the clearance between tracks and the heights of tunnels, overhead bridges and other structures definitely limit the size of a locomotive in two directions, the only way to build a bigger one is to make it longer,

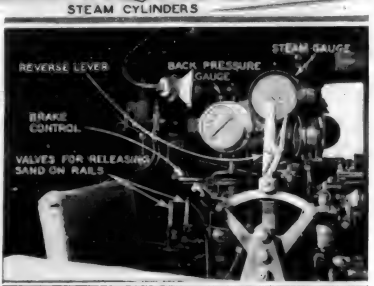


Cross-sectional view of the British "hush hush" locomotive, so-called from the secrecy which surrounded its design. Note the unusual front-end design—there is no smokestack.



This type of locomotive, which apparently is built backward with the cab in front, is unique with the Southern Pacific. It is used on mountain runs where the novel cab arrangement keeps smoke from obscuring the engineer's view in tunnels.

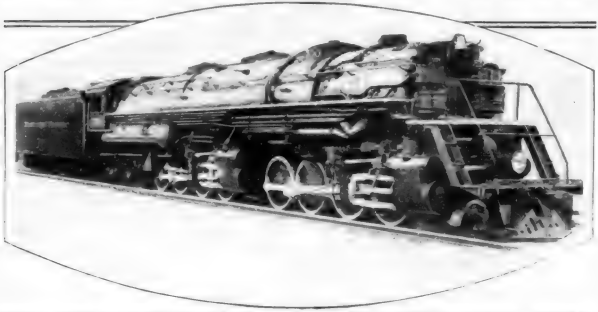
and that explains the 125 foot length of these monsters. With their four cylinders, a normal tractive power of 140,000 pounds, and a starting power of 153,000 pounds, when the booster engine on the trailer is in use, they are able to haul trains over the mountain division twice the size of any trains hauled there before by a single locomotive, and at higher speeds.



Engineer's seat in the Southern Pacific locomotive. Novel arrangement of controls is necessary because of position of cab.

Locomotives are always rated by tractive power, rather than horsepower, for their efficiency depends on the weight they can start from a stand still. The rating for weight on the driving wheels is also important, for the more weight there the less chance of wheels slipping. That's why switch engines are often of 0-4-0 or 0-6-0 type, the zeros indicating there are no pony or trailing trucks, and therefore all

Four Cylinders, Sixteen Drive Wheels on Giant Northern Pacific Engine



Northern Pacific four-cylinder freight hog, designed to burn low grade fuel. Tractive power, 140,000 lbs.

the weight is concentrated on the drivers.

The modern engineer sits on an upholstered seat in an electric lighted cab, surrounded by levers, gauges, knobs, wheels and signal lights. He even rings the bell with a small steam engine, instead of pulling the cord.

In front of him is a throttle lever, and at his left side the long reverse lever, sticking up through a hole in the floor. (This description is correct for all railroads but the Chicago and Northwestern, the only left handed railroad in America, with trains running, after the English fashion, on what we regard as the wrong track, and the engineer, as a result, on the left side of the cab.)

Railroad men have a very convenient way of telling how fast an engine will run. Roughly, the maximum speed of an engine, in miles per hour, is the same as the diameter, in inches, of the driving wheels. In other words, a freight locomotive with 60 inch drivers has a top speed of 60 miles an hour, and a passenger engine on 72 inch drivers will do 72 miles an hour; that is, on level track.

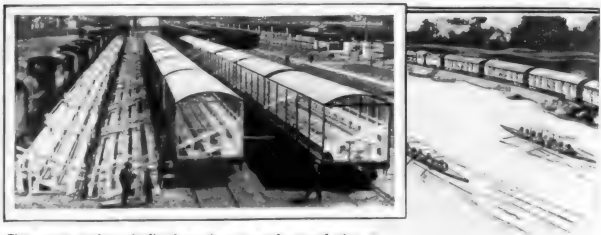
The bigger and better boilers of modern engines have made it possible to add more cylinders in recent years. Thus, in addition to the usual two cylinder types, there are engines with three, four and six cylinders. The Union Pacific 9000 Class has three cylinders, the third being mounted under the boiler, and connected by a rod to a crank in the front driving axle. This is a 1-12-2 type engine, with six pairs of driving wheels all connected by side rods. The three cylinder type, however, has not proven very popular with railroad men owing to the difficulty of servicing and repairing the guides, rods and crank under the boiler.

Something radically different in engines is the 4100 Class of the Southern Pacific, technically described as single expansion, articulated, 4-8-8-2 type. They are built backwards, with the smokestack end at the rear and the cab in front. Twenty-six of them have been built for use in the Sierra Nevada mountains and 25 more have been ordered.

The peculiar arrangement, made possible by the fact that they are all oil burners and hence do not require the presence of the fireman at the tender, was adopted to keep smoke and gases out of the cab while passing through numerous long tunnels. Smoke is so bad in tunnels that many engineers and firemen have to wear gas masks. The 4100 Class engines measure 120 feet, weigh 906,700 pounds, and have a tractive force of 112,760 pounds. Compare that to the Southern Pacific's original engine, the C. P. Huntington, built in 1863. It weighed 39,000 pounds, was 32 feet long and developed 3,510 pounds of tractive power.

Instead of mounting gauges on the boiler head, they had to be carried forward alongside the engineer, who sits with his back to the boiler.

New Style "Traveling Grandstand" Seats for Crew Races



Circus seat sections, inclined to give an unobstructed view to the front, are mounted on steel gondola cars as shown.

DUE to the unusually large crowd which reserved "grandstand seats" for the Harvard-Yale crew races this summer, the New Haven railroad was compelled to exert its ingenuity to devise a "traveling grandstand" which would provide 800 extra seats. Four tiers of benches with backs were built into circus seat sections on the ground. These sections were mounted onto 36 steel gondola cars which were provided with awnings supported by frames of steel tubing.

Starting with the two-mile freshman contest, the sightseeing train follows the various races from start to finish; the varsity race over a four-mile course being the climax of the day.

Hair Raising Electric Chair

150,000 volts shot through body without harm.

ONE of the features of a recent engineering show held in Portland, Oregon, was the electric chair shown here, in which a man was seated while an electric charge of 150,000 volts was passed through his body. The experience left the shockee with no ill effects, although the picture shows his hair to be standing on end; but even the prospect of such a shock would be enough to cause this.

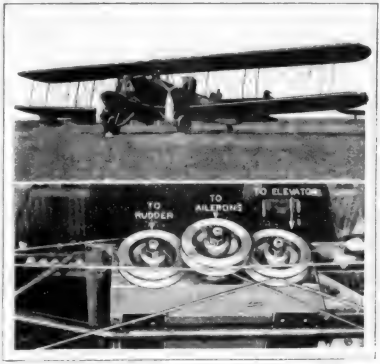
Turntable for Narrow Streets

TRAFFIC experts of Paris have found it necessary to install automobile turntables in certain of its narrow streets so that cabs and autos may be turned around without having to go miles out of their way to find turning places. Mounted on roller bearings which offer but little friction resistance, these turntables are easily operated by turning a hand-crank situated on the curb which is connected to the center post.

Crank for turning table is mounted on curb.

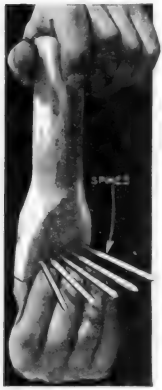
Giant Bombing Plane Flies With Only Mechanical Pilot

SOME idea as to what aviation may come to in the future is revealed in the flying stunt recently performed at Mather Field, California, where for the first time in aeronautical history a giant bombing plane, shown in the upper photo at the right, made a flight piloted only by a gyroscopic compass, otherwise known as the "gyro-pilot," an invention of the late Lawrence Sperry. The plane took off from Mather field under the guidance of Major Hugh J. Knerr, commander of the Second Bombardment Group. At an altitude of 2500 feet, the controls of the mechanical pilot, shown in the lower right photo, were set, and Major Knerr left the cockpit accompanied by a parachute. The "Gyro-compass," connected to the three controls of the plane by means of drums and cables, brought the plane to a safe landing in San Francisco.



Above: Giant bombing plane guided by Sperry "Gyro-pilot." Below: Mechanism of the "pilot" that connects with controls.

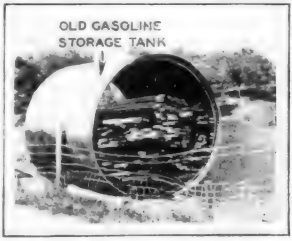
Knot and Spikes Make Weeder



A HANDY and economical scratch weeder that is large enough to permit digging down deeply into the earth can be made by following the photo at the left. Only a short piece of knotty wood and five 20 penny spikes are needed. The wood should be cut green, and whittled away at the fork knot to form a small paddle. Five small holes are drilled in the head and the spikes driven through them.

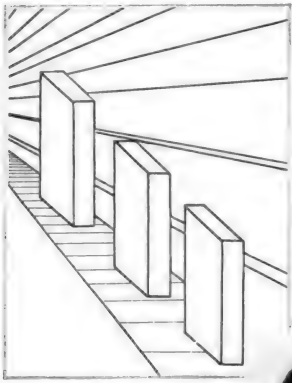
Lumber Stored in Old Gas Tank

DURING some recent highway construction in Iowa, an old gasoline storage tank was dug up and left on a farmer's land. Instead of cutting it up, selling it to the junkman, or otherwise trying to get rid of it as an unsightly obstruction, he rolled it over to a convenient place near the barn, blocked it so as to secure stability, and thereby secured an excellent lumber storage shed. The shed is fireproof and windproof.



This discarded gasoline storage tank was utilized to make an excellent lumber storage plant.

YOU Can't Always Believe



A deceptive illusion of perspective. The three blocks are the same size.

HAS this ever happened to you?

You go to a photographer, look handsome or pretty as the case may be, and have several portraits made. When you get the proofs you select the pose that looks the most flattering, and order a dozen prints. When you receive the finished pictures, nicely mounted, you are delighted . . . and then it dawns upon you that there is something wrong with the pictures, but you do not know exactly what it is. If you have had this experience, you have encountered a common illusion that follows nearly everyone through life. That is the impression of your appearance.

"Surely, I know how I look," you exclaim. "Haven't I seen myself in mirrors often enough?"

That is just the trouble. You see only the mirror-image of yourself—the right side of your face on your left; while everyone else, including the photographer and his camera, sees you as you really are. Probably, if the photographer had printed all of his negatives backward, you would have been better satisfied with your portraits.

Incidentally, speaking of faces, did you know that your cheeks are not mates? The right side of your face is not an exact duplicate, in reverse, of the left side. This can be proved by taking two photographs, one printed backwards; cutting them in two lengthwise, and joining the halves so that two right sides and two left sides are together. The result will be two individuals, neither of which resembles the original to a very great degree in many cases. If your cheeks were mates, it would make no difference whether your portrait were made backwards or not.

Do you have any picture frames on the walls of your home which do not appear to be strictly rectangular? If you do, the grain of the wood undoubtedly is quite prominent—unless the frame actually is untrue. The curved grain of wood may exert such an influence upon your vision that you swear that the picture frame is crooked—and only are convinced of its straightness by actual measurement. Similarly, the end grain of boards will influence your eyes so that the board may appear perfectly flat when in reality its surface is far from plane; or a really straight edge may look curved.

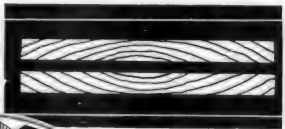
Proving that the halves of the face don't match. The face at the left is made up of two left halves of a portrait; the other of two right halves. The true portrait is on page 75.

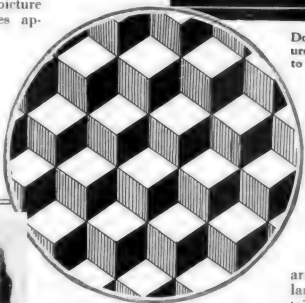
What YOU SEE

by WALTER E. BURTON

Your impression of the length of lines is influenced by the position and dimensions of neighboring lines. For example, a line four inches long that is perpendicular to another line of the same length, and whose end joins this second line in the center, seems to be considerably longer. Similarly, a picture of a tower sometimes appears to be longer than it is wide, even though the length of the base line and the tower are the same.

If you are building a house, you can make use of perspective by laying the roof shingles so that the exposed length is greater at the bottom than at the top, and gradually changes between the two extremes. Thus your roof seems to be much greater in expanse than it really is. In a like manner, a tower or office building of moderate height can be made to appear taller by making the height of its successive stories or sections decrease more rapidly than normal perspective requires.





Do the long sides of the figures above appear straight to you? They are—proving that the end grain of boards can deceive the eye by producing the illusion of warping.

At left—The arrangement of cubes in the circle will shift as you watch them. Diagrams used through courtesy of M. L. Luckeish, author of "Visual Illusions."

Here's the true-to-life portrait of Billie Dove, movie star.

Shifting attention is responsible for the effectiveness of designs often used in posters, quilts and other places where the eye is to be attracted. One of the most common of these "restless" designs is that consisting of rows of cubes which seem to change their arrangement with regularity. This effect is obtained because the eye sees the figures in first one and then the other of possible positions. In fact, you never look at any point steadily for any great length of time. Your attention is constantly shifting.

The next time you are out walking, you can try an interesting experiment with an illusion that often is noticeable in moving pictures. Carriage wheels in the movies sometimes appear to stand still or revolve backwards while the carriage or motor car proceeds forward. This is caused by the intermittent photographing of the wheel spokes in their same relative position. By watching a spoked wheel revolve while exhaling your breath forcibly so that your lips or tongue vibrate to such an extent that your eyes in turn are caused to vibrate, you can obtain the same effect. Sometimes, when walking, you will notice that automobile wheels apparently pause in their turning at the instant your foot strikes the ground. Here, again, jarring of your optical apparatus causes the illusion.

All of which goes to prove that you can't always believe your eyes.

Puzzling Zipper Fastener Is Really a Simple Device

Above is an enlarged view showing guide which contains wedge. Drawing at right illustrates principle.

THE "Zipper," long a popular fastening device for purses, sweaters, galoshes and other articles of similar nature, has remained a mystery to most of its users although, as the pictures here will show, the device is simplicity itself. The little wedge-shaped affair which appears to sew up or rip the article at will contains a scientifically shaped wedge which spreads the arms at just the right angle so they will release the socket from the arm below and opposite. Reversing the operation guides the knobs on the arms back into the tiny sockets where they hold firmly.

Mark Point of Balance

IF YOU find it necessary to carry a ladder or other long bulky object frequently, it is advisable to balance it and mark the center to save future difficulty in carrying.

Easy Way to Transfer

CARTOONS, drawings and photoprints may be easily transferred from newspapers, books and magazines to paper, cloth, wood, eggshells, etc., in the following manner:

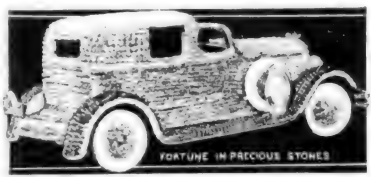
Dissolve one tablespoon of white soap powder, or an equal amount of shaved soap, in one-half pint of boiling water; add two tablespoons of spirits of turpentine and stir until cool.

With a bit of cotton or a soft brush apply the solution to the surface of picture to be transferred. Blot slightly, place face down with a piece of paper over it. Rub with bowl of spoon or other smooth object to effect transfer.

World's Most Expensive Auto Sparkles With Seven Thousand Gems

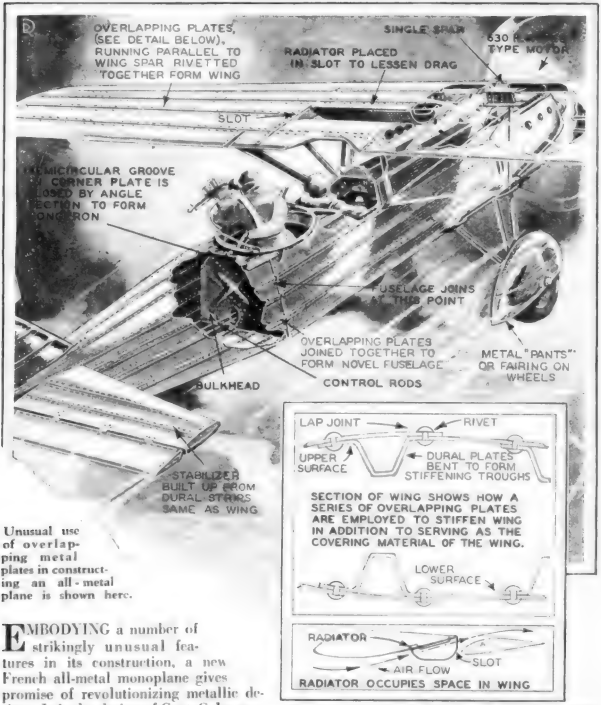
THIS little town car is made up of a preponderant assortment of precious gems. The body contains 3,000 fine diamonds over half of which are square or ornate in shape, while an exquisite pair of briolettes is used as side lamps.

A sweeping streamline is given the body through the use of 1,000 oriental rubies. The fire holder is enhanced by the famous Australian opal.



This auto, decorated for an advertising display by a Cleveland jeweler, contains more than seven thousand precious stones.

All-Metal Airplane Has Novel Features



Unusual use of overlapping metal plates in constructing an all-metal plane is shown here.

Showing how troughs in plates strengthen wings.

EMBODYING a number of strikingly unusual features in its construction, a new French all-metal monoplane gives promise of revolutionizing metallic design. It is the design of Capt. G. Lapere, the French designer who came to America in 1917 and built the famous Lapere biplane in which Lieut. John Macready established new altitude records.

The entire structure of wings and fuselage is built up of narrow dural strips riveted together, doing away with the usual wing ribs, longerons, and struts. The wing is built in five parts around a single spar. A radical feature of design is the location of the radiator in slot in the center section of the wing, obtaining more effective cooling with less disturbance of the air flow about the wing. Overlapping dural plates of the wing are folded as shown in the illustration to form a deep trough, and riveted together with the trough on the inside of the wing to present a smooth outer surface. The fuselage is built in three sections.

LEARN to FLY

Howard Wagle, of San Francisco, wins the seventh free flying course.

The second prize goes to Martin A. Bystrom.

And Raymond Babcock cops the flying goggles.

Here are the winners of Flying Contest No. 7. Another contest announced!

STAND by, you flying fans, for announcement of the winners of MODERN MECHANICS' Flying Contest Number Seven! The judges have emerged from their conference, their heads whirling from perusing thousands of letters, and have announced that Howard Wagle, who lives at 4138 Balboa Street, San Francisco, California, is winner of first prize and will receive the seventh flying course with all expenses paid by MODERN MECHANICS.

But don't imagine that Mr. Wagle had no competition. Seventeen-year-old Martin A. Bystrom, of 715 West Third Street, Elmira, New York, sent in a set of answers that was a Lulu. The judges almost came to blows over choosing between Wagle and Bystrom, but Wagle won. Oh well, don't give up, Martin, you may cop the coveted course yet. That helmet is going to be a dandy.

Raymond Babcock, another seventeen-year-old youth, who lives at the Moran Apartments, Main Street, Canton, Ohio, walks off with the pair of real flying goggles. While not in quite the same class with the first two prize winners, there wasn't much argument about Raymond taking third prize. This is his seventh try, and his entries have always received the serious consideration of the judges.

Don't you flying bugs imagine that neatness isn't noted. Raymond's entries have always been a model in that respect. He must have ready access to a print shop, for his neatly typewritten answers are always bound with a printed cover; this time in gold letters on green paper. Several excellent entries have been passed over in each contest owing to lack of care in preparation. Take a tip from Raymond and put a little thought on appearances. The prize is well worth the effort.

By the time this issue of MODERN MECHANICS reaches you, Howard Wagle will be well started in his complete flying course at the Von Hoffmann Flying School, at St. Louis, Missouri. His fare and travelling expenses will be paid to and from San Francisco; also his room, board and incidental expenses. He will even be furnished with a flying helmet and a pair of the most up-to-date goggles. All of this will be paid for by MODERN MECHANICS.

You fellows who have been following these contests will be interested to learn that Lewis Slemmer, who was the winner of

Win Your Wings!
Modern Mechanics pays all expenses for a complete flying course each month.

Win Your Wings Contest Number 3, has soloed after only six and one-half hours of dual control. He will finish several hours of solo flying, so will have a few hours toward his license.

And now a few words concerning Flying Contest Number Eleven. All you have to do is answer the six questions scattered among the ads in the advertising section of this issue of MODERN MECHANICS. The contest closes at midnight, August 15, 1930, and all entries must be postmarked before that time in order to receive consideration. Don't forget to enclose an entry blank and your photo — a snapshot will do. Remember! Neatness, a knowledge of the subject and adequacy of answers will count. Let's go! This may be your big chance!

WIN YOUR WINGS!

Rules of the Contest

For the best answers to the six questions that can be found in the advertising section in the back of this issue, as determined by the contest judges, MODERN MECHANICS will award a complete flying course in some recognized flying school, paying all expenses of tuition, living costs, railroad fares and for some needed equipment in the form of helmet and goggles. Neatness, originality and adequacy of answers will be the guiding factors of the judges in determining the winner. Second and third prizes will be awarded as announced elsewhere on this page. It is not necessary to be a yearly subscriber to the magazine.

Anyone may compete who is 16 years of age or over, and a resident of the United States or Canada. Members of the staff of this magazine are, of course, not eligible to enter. Address your letters to Flying Contest No. 11, Modern Mechanics Magazine, 501 Seventh Avenue South, Minneapolis, Minn. Entries must be postmarked not later than August 15, 1930, to be eligible for this contest. Clip or copy the entry blank below and attach it to your letter. Fill in the information requested. Include a snap shot of yourself, if possible—a big photo isn't needed; just a kodak print.

It is not necessary to buy a copy of the magazine to compete. In case of a tie, duplicate prizes will be awarded. Fill in the entry blank, answer the questions and send in your entry now. Don't forget to include your photo!

Entry Blank

My name is .....

Address ..... City ..... State .....

Age ..... Height ..... Weight ..... Sex .....

If under 21, please answer the question below:

Will your parents consent to your learning to fly? Parent's signature .....

Attach your answers to the questions, and your photo, to this blank. Mail it before August 15, 1930, to

FLYING CONTEST NO. 11
MODERN MECHANICS MAGAZINE
501 SEVENTH AVE. S., MINNEAPOLIS, MINN.

Von Hoffmann SCHOOL

One of the eleven hangars at Lambert Field, St. Louis, the home of the Von Hoffmann School.

THE Von Hoffmann Flying School, situated at Lambert Field, St. Louis, has been selected as the place where Howard Wagle, of San Francisco, winner of Flying Contest No. Seven, will receive his flying course at the expense of MODERN MECHANICS.

The School of Von Hoffmann was one of the first schools to receive the highest rating by the Department of Commerce. An inspection of several days preceded the formal approval of this school, and during this inspection every piece of equipment, every text book and piece of school literature was carefully examined by the Department of Commerce.

Every instructor in the school was required to pass a written examination and every course they taught was gone over carefully with them. That the Von Hoffmann School received the coveted rating means that the Department of Commerce is satisfied they are doing a safe and honest job of instructing students in the art of flying. It means that every flying instructor is a licensed transport pilot and that every flying student must have passed a physical examination and have a flying permit. It means that student work and repairs are conducted under licensed supervision and that no makeshift work is done in any classroom or hangar.

It was from Lambert Field that Lindbergh flew the air mail to Chicago by day and night in all kinds of weather—a task that fitted him for the great adventure that made him famous, and it was St. Louis capital that backed his venture with $25,000 that made possible his great flight. It was here that Dale "Red" Jackson and Forrest O'Brine flew the St. Louis Robin continuously for 421 hours to set an endurance flight record that still stands.

Students at Von Hoffmann School learn to repair and fold parachutes under expert supervision.

When Howard Wagle arrives here, perhaps the first thing that will catch his eye will be the great hangars of this modern school. They are the largest on the field, the newest one being filled with twenty-four airplanes of ten different types, ranging

TRAINS Contest WINNER

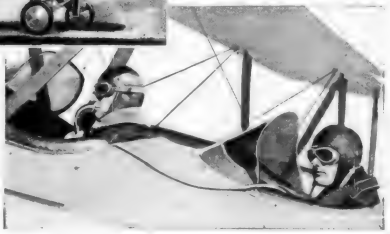
Five passenger lines, four air mail lines, and two airplane factories are located at the flying field.

from the tiny Fleet to the big Ryans, Stinsons and Fords. A trip through this hangar is an education in itself.

It is not an unusual sight to see twenty planes warming up on the line in the morning as the youth of the country bustle about, winning their wings at this great school of the air. The chief instructor stands at one end of the line and as each pilot signals that he is ready to go aloft, he is waved to the runway and skims off to start another day of instruction.

By the time the last plane is out, the first one is coming in. And so it goes for most of the day, planes roaring and humming, in and out, a continuous whirl of student activity.

While the flying is going on still another group is busy in the class hangars. The latest class to enter the school is probably busy in the wood-working department, building ribs and fitting them. Others are assembling or rigging a plane while another group in the welding department are fashioning a fuselage to carry the wings being assembled.



Travel-Airs, Eaglerocks, Fleets, Swallows, Ryans and Stinsons, all of them clean and in perfect mechanical condition, are used in training Von Hoffmann students. Above is shown an Eaglerock Kinner powered training ship. At the right is shown how the instructor is in constant touch with the student by telephone in dual control; a great improvement over the old deaf and dumb signals.

A swift pursuit plane laying a smoke screen of tetanium tetrachloride to cover the advance of infantry.

By FAIRFAX DOWNEY

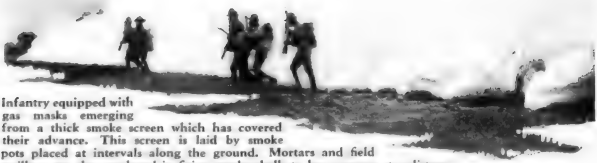
Armor plate for soldiers went out of style with the Knights of the Round Table, but modern armies go into battle clad in an entirely new type of protective armor—smoke! Important recent advances in the wartime use of smoke screens are set forth in this authoritative article.

WHEN knights joined combat with dragons in the old wonder tales, the monsters did not depend on their tough scales to protect them, but puffed out heavy snorts of smoke through their dilated nostrils. Most of the stories relate that the knights went right ahead regardless and slew the dragons. Still there must have been some occasions, which did not appeal to the story tellers as good material, when the hero, lost in his adversary's fog, suddenly found the dragon on his neck and became a casualty.

The fabulous old dragon defense has become an actuality of the present. Already well established for use by battleships, the smoke screen has been moved from the seas to the land, and tests have proved that it can be laid down in a novel and effective manner by airplanes, tanks and mortars. This is among the recent developments of the Chemical Warfare Service of the United States Army.

Smoke joins the artillery barrage and armor to shield the troops who must advance against the tremendously heavy fire of numerous machine guns as employed today. Cannon and munitions are expensive. So is armor as represented by its modern survival in the plating of tanks and in helmets and sniper breastplates. As Major General H. L. Gilchrist, Chief of the Chemical Warfare Service, points out, smoke as a supplement to these other major protective devices is both economical in permitting the reduction of the masses of artillery required, and saving of life in the concealment it affords.

the Modern Armor



Infantry equipped with gas masks emerging from a thick smoke screen which has covered their advance. This screen is laid by smoke pots placed at intervals along the ground. Mortars and field artillery are also employed in firing smoke shells to lay a screen at a distance.

"Smoke is about the only possible protection other than the speed of the mechanized force itself, against the semi-automatic weapons," said Maj. Gen. Gilchrist, a veteran of the Spanish and the World wars. The Infantry Board has carried out a test of the smoke screen apparatus for tanks. The board found that the mechanical elements and their functioning were in general mechanically satisfactory, and that the smoke properly laid down will assist in the advance of attacking riflemen.

Tanks advancing under cover of clouds of smoke in which they envelop themselves will not only afford a greater degree of safety for their accompanying infantry but for their own advance. In spite of increased speed and higher proof armor, tanks are still vulnerable to direct hits by field artillery and the lighter types can be put out of action by the armor-piercing bullets of heavy machine guns. Smoke shields will do much to destroy the accuracy of anti-tank fire.

Another new agency for the spread of the smoke screen is the low-flying airplane.

"Specifications for the construction of atomizing apparatus for airplanes have been prepared, and instructions for their use have been written," Maj. Gen. Gilchrist declared. "A number of these apparatuses have been constructed and successfully employed for the production of smoke screens in a great number of demonstrations and field tests."

The airplane atomizers are an adaptation to special war use of the smoke spreading machines used by airplanes for combating boll weevils and other insect pests and for sky writing. They make of a plane a great rocket with a dense column of smoke for its train. Tetanium tetrachloride, which combines with the moisture of the air to form a dense, white smoke, is the chemical

Smoke screens were first employed at sea to conceal the maneuvers of warships, the smoke being furnished from their own funnels. Today, however, naval smoke screens can be laid by airplanes, as shown in the photo at the left, in which the airplane-carrier Lexington is shown emerging from a dense screen laid by one of her fighting planes. Note how completely the smoke conceals the ship.

sprayed from the atomizers.

Airplanes equipped with atomizers may be employed not only to thicken the tank smoke screen for advancing infantry, but as an auxiliary to their own arm, the air service. Smoke apparatus may be installed on the swiftest pursuit planes to allow them to blanket an anti-aircraft position or a column of infantry or artillery on the road. The speed of these planes will reduce their own hazard. After them will follow the slower, more vulnerable bombing planes which thus will be able to attack in comparative safety targets which are both clearly defined by the narrow column of smoke enclosing them and largely prevented from returning an effective fire by its blanketing clouds.

Phosphorus bomb exploding as a plane scores a direct hit on the tower.

Smoke shells for forming heavy clouds in the positions of the enemy to confuse their aim and force the use of masks are still in the province of the field artillery. Smoke is also used in the Livens projectors, high-angled tubes buried in the earth in a row and firing their bombs when detonated by an electrical connection. But high explosive shell or shrapnel is usually a more useful ammunition for field artillery, as the projectors are limited to a range of 1,500 yards; this involves difficulties in locating them so far forward, and their usefulness is also impaired by their lack of mobility. The preeminent weapon for smoke bombs is the Stokes mortar, which is now rifled. Copper rotating plates fitted around the base of the new projectile expand slightly on the explosion of the powder charge, catching in the rifling grooves and giving the mortars greater accuracy and a range increased to 2,500 yards.

This flexibility has been added to by an innovation in the training of the experimental mechanized force at Fort Meade, Md., where platoons have been armed with 4.2 chemical mortars mounted on hand carts. To accompany a motor transport train, the mortar carts and their gun crews are carried in trucks. Unloaded from the trucks in the vicinity of the "front," the cart platoons have no difficulty keeping pace with the infantry in attack problems. Mechanization and the use of the smoke screen follows the recommendation of Gen. Charles P. Summerall, Chief of Staff, who stressed the fact that the army must to the fullest practicable degree use machines in place of man power in order that our man power can occupy

Naval plane laying a smoke screen. The chemicals, heavier than air, drift slowly to the water's surface.

and hold positions without terrific losses incident to modern fire-power.

The Chemical Warfare Service is now organizing a most unique unit, a field laboratory chemical company, one of which will be included in the strength of each field army of our forces.

"Such a laboratory," Maj. Gen. Gilchrist declared, "is necessary in order that enemy compounds, if used, may be analyzed and protection secured." It will readily be understood that quick action would save many lives in the event of an enemy springing a surprise attack with a new chemical agent. Instead of having to depend on the collection of data by line troops without chemical training and undergoing the delay of transmission to a laboratory at a base, the field unit, which is motorized, will soon be on the spot. Its experts will have their equipment at hand to solve the problem and plan counter-measures.

The scientific nature of modern warfare is epitomized by the tables of organization of this unit. It will consist of both a chemistry and a physics laboratory with all the required apparatus and instruments. The personnel, under the command of a major, will consist of officers who are chemists and physicists, with master sergeants and other trained non-commissioned officers for their assistants. Two officers will be mechanical engineers. There will be two translators whose duty it will be to decipher the marks on enemy shells and fragments and interpret captured books of instructions for new devices in use by the enemy and other documents obtained. Special munitions handlers will bring in the enemy's duds or unexploded shells for analysis of their content. Samples of contaminated soil and materials will be analyzed for new enemy chemical agents and emergency protection devised. It is probable that the laboratories will be called on for advice in cases where there is a contamination by persistent gases of places which can not be evacuated and which do not readily respond to the ordinary de-gassing measures. Draftsmen and mechanics are on the roster to aid the scientists in devising up-to-the-minute protection. Orderlies, cooks and other personnel required by an army outfit complete the unit.

Photo shows new type gas mask.

Details of the post-war gas masks already are known: its elimination of the old uncomfortable nose clip and mouth piece, the passing of the breath inhalations of the wearer over the eye pieces to clear them, and in the type for troops requiring a communicate, a pressed metal diaphragm, impermeable to gas but transmitting the voice. Newer improvements are embodied in a type with a universal size face piece, screw-type eye pieces and a sun-proof hose tube. Further experiments are being made toward the improvement of voice and vision transmission, particularly in an optical type mask designed to facilitate the use of field glasses.

Foresight in the procurement of materials

Livens projectors, shown in top photo, are effective in hurling gas containers for distances up to 1500 yards. Below—Army mules must wear gas masks, too.

vital in war has prompted the investigation in the field of substitutes for gas mask canister filling. The present standard filling is activated cocoanut carbon. Since the stoppage of some of our sources of cocoanut supply is a war possibility, a substitute for use in an emergency has been found in an activated coal carbon. This has been produced in a small scale experimental plant.

Protection of the skin of the soldier as well as of his lungs against chemical agents has also had the attention of the Service, Maj. Gen. Gilchrist reported. The possibility of a great advance over the cumbersome rubber clothing in use during the World war is seen in the satisfactory conduct of tests on the regular uniform treated with a protective impregnation. Research will delve deeper yet in the study of defense measures to be taken against chemical agents which may affect automotive and mechanized equipment. Just as the horse has been provided with a gas mask, his companions in transport, the truck and the tractor, may conceivably require protection against some ingenious chemical attack. Devices to protect ships, too, against chemical agents may be necessary, and this project has been undertaken by the Chemical Warfare Service at the request of the Navy Department.

The Chemical Warfare Service maintains one R.O.T.C. unit at the Massachusetts Institute of Technology, and holds an annual camp at Edgewood Arsenal, Md. Two hundred and ninety reserve officers were trained last year at the Arsenal and in other groups.

With these preparedness measures for national defense, the Chemical Warfare Service continues its collateral work on peace time problems. Recent prison breaks have shown the value of the tear gas bombs which the Service put forward as far back as 1920. It was prompt to investigate and report fully on conditions incident to the Cleveland Hospital X-ray disaster. It has made valuable experiments in preservative chemicals for pilings, posts and ship bottoms. Its work on boll weevil killing agents has been of economic importance. Also it has had a share in the development of ammonia and other masks, as well as in other means of protection against industrial poisoning.

In a recent mimic battle staged by the Army air corps above the city of Sacramento, California, an airplane equipped with smoke-laying apparatus flew above the city in a spiral course, spouting a dense cloud of chemicals from its tail. It was a bright, sunshiny day, but within a couple of minutes the city lay in the shadow of a thick cloud in an impressive demonstration of the speed and effectiveness of chemical defense.

It is to the achievements mentioned in the foregoing article and to others that the Chemical Warfare Service points as justifying its continual research to maintain chemical defense in peace or war.

Bike-Boating Latest Water Sport

The bike-boat is an adaptation of the catamaran and bicycle, two well-known principles.

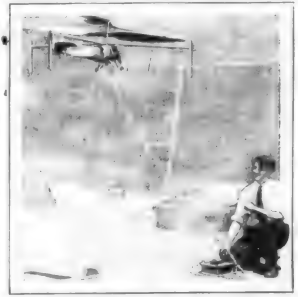
BIKE-BOATING, a water sport recently introduced in California, gives promise of becoming an exceedingly popular pastime. The bike boat consists of two light but sturdy pontoons with an ordinary bicycle frame mounted between. A worm-geared shaft transmits the human power from the pedals to the propeller while the handlebars are connected to a rudder at the stern. An extra seat is provided for a passenger. That this unique craft is seaworthy is proved by the fact that one of the first machines successfully crossed the English Channel—one of the roughest bodies of water in the world.

Two Hundred Miles by Heliograph

SINCE the advent of radio telegraphy the tendency to depend more and more upon radio has grown with a consequent neglect and inefficiency of visual communications, is a warning of the Coast Guard communications section, of which Lieut. E. M. Webster, Jr., is the head. "In time of war, radio science will be imperative," Mr. Webster goes on, "and no message will be sent by radio if it can be sent by land, wire or visual." It is, then, extremely desirable that a high rate of efficiency in visual communications be maintained. The most commonly used methods of visual signaling, according to Lieut. Frank Meals of the Coast Guard, are the heliograph, the blinker light, the signaling searchlight, the semaphore and the wigwag. "The heliograph is probably the most efficient, in point of distance covered, of all visual signaling appliances," Lieut. Meals declares.

Model Helicopter Rises

THAT the helicopter principle is sound has been successfully demonstrated by Valentine Newbauer, of Los Angeles, whose working model of a vertical rising plane rose straight into the air and made a gentle landing when the power was turned off. Two propellers, mounted on a vertical shaft and revolving in opposite directions, lift the plane, while a third propeller in front drives it forward.



Electric motor is controlled by ground switch.

Diving Bell Permits Camera to Explore Ocean Depths

THE diving bell pictured here, which was designed by Otis Barton and is now being constructed by the New York Museum of Natural History, is to be shipped to Bermuda, where William Beebe, the noted explorer, will attempt to make observations and obtain pictures at great depths.

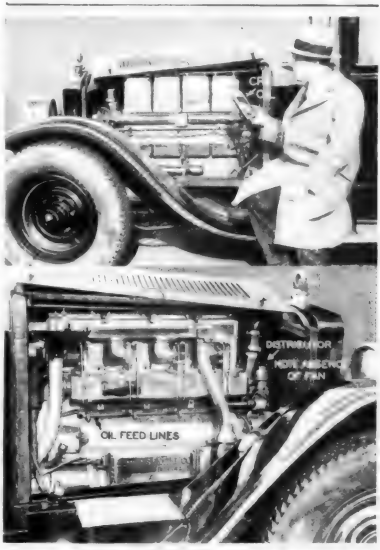
The main body of the bell is one enormous steel casting designed to withstand terrific pressure. Access to the interior is gained through a small port which is closed and locked like a bank vault. Three "eyes" are fitted with quartz glass three inches thick.

Indianapolis to New York on $1.38 With Diesel Engine

THE cost of motoring should soon be materially reduced, for Clessie Cummins, a mid-west inventor who for some time has been engaged in the manufacture of Diesel engines, recently placed his motor in a car not especially designed for that purpose and drove from Indianapolis to New York at an average speed of more than thirty miles an hour at the extremely low fuel cost of $1.38.

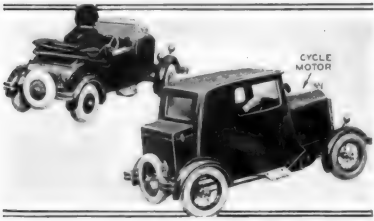
The Cummins engine, which is a 4½x6-inch four-cylinder motor using crude oil for fuel, was placed under the hood of a stock Packard car. The only alterations necessary were the removal of the fan belt and a change in the gear-ratio from 5:1 to 2.5:1. The latter change was necessary owing to the low speed of the Diesel engine of 1000 r.p.m. With this change in the gear-ratio a speed of 55 m.p.h. was attained. A 12-volt motor-generator was used for starting, and at a temperature of 11 below zero, started the engine immediately, although the car had been standing idle out of doors for three days.

This experimental trip of 792 miles was made to test the ability of the engine under road conditions.



The Cummins Diesel engine installed in a Packard chassis.

Toy Automobiles With Real Motors Displayed in England for First Time



Cars are equipped with pneumatic tires and electric lights.

IN THESE modern times when motor cars are playing such a prominent part in family life, the children have such an advanced knowledge of the auto that they demand that their toys be correct in every detail. These miniature cars, which were recently displayed at a British automobile show, are equipped with motorcycle engines, pneumatic tires, electric lights, starters, and all other modern accessories. The little fabric coupe pictured here is the first of its kind.

CAMPING Kinks

This lake-shore camp, set up by experts, contains necessary comforts without being over-elaborate.

I TALKED to three people today about camping.

The first was an Indian who was busy preparing his dinner. His equipment consisted of a battered pail, a small frying pan and a waterproof match box. He cut three inch thick poles about eight feet long, lashed them together at the top to form a tripod; cut a two foot stick with a limb notch pointing upward at the lower end, tied it to the tripod with a piece of bark, hung his pail on the notch and started a fire with a double handful of birch bark. At no time while he cooked his dinner was his fire bigger than what you could hold in a dinner plate.

The second was a fisherman who estimated that a twenty-five pound haversack load plus a ten pound bed roll, and a belt axe and knife was all anyone should need on a two weeks' hiking trip, and probably too much to carry comfortably.

The third was a salesman demonstrating a "land yacht"—a species of two wheel auto-trailer split down the middle so that it could expand outward to nearly twice its normal width, while the roof rose upward to give generous headroom. Inside there were some forty cupboards, drawers, shelves and tables, four Pullman beds, three tables, and seating room for ten guests at dinner. There were electric lights, running water, electric cigar lighters, and a telephone connection to the driver of the towing car.

A paddle makes a good fish-cleaning table.

Somewhere in between the two extremes lies the ideal kind of camping equipment for any sort of trip off the beaten path. Outfitting for a vacation depends, of course, on where you are going, how you are going to travel, how many are in the party, whether it is a mixed group, how far be-

for VACATIONISTS

by BEVERLY BARNES

If you're one of the ten-million-odd Americans who will go motor touring this summer, you'll find this article on camping tricks invaluable. Proper preparation is the secret of comfortable camping — preparation, and a knowledge of a few simple tricks which make outdoor life easier. Everything you need to know is treated in this article.

tween sources of supply, and individual taste.

Here's the description of an outfit for two men on a canoe trip through the north woods, with settlements, allowing for plenty of loafing along the way, about two weeks apart. It will give an idea what to take on any kind of trip, what not to take, and some little kinks to make the trip a pleasure instead of a period of hard work. If you are going to travel on foot you will have to lighten the suggested outfit, and if you go by automobile you can add to it considerably.

To begin with, one man's personal equipment on a canoe trip in northern New England, the Great Lakes states, the northwest or in Canada should include:

One towel, soap in a tight case; two pairs of heavy woolen sox, spare suit of underwear, half dozen handkerchiefs, small first aid kit, or, in place of it, mercurochrome and adhesive tape, shaving kit, needle and linen thread, supply of snap-on buttons, pocket lighter, spare flints and can of lighter fuel (expert campers don't carry matches any more), a good jackknife or belt knife, small belt axe and a good pocket compass.

A ten pound bed roll can contain a rubber ground sheet, pair of good blankets—the Hudson Bay 3-points weigh 8 pounds 5 ounces per pair—a silk fly or silk tent, and a supply of mosquito netting. A length of light line, such as carpenter's chalk line, stretched between two trees will support the silk fly and turn it into a serviceable pup tent.

A fine fishing stream in northern Ontario. Photo from Canadian National Railways.

If you fish in streams like this, you'll need knee-high, water-tight boots. A few tree branches, arranged as shown at the right, with a notched stick to hold the coffee pot, make an ideal cooking fire.

Mosquito netting is optional, but rather serviceable at night. The camp cooking equipment for a small party should include one deep frying pan, one square or oblong bread pan, one gallon pail with bail and tight fitting cover, pint tin cups, including one extra for general use as a ladle; and, if you want the tin plates and knives, forks and spoons. My fishing friend does not carry plates, knives or forks, considering them unnecessary in a compact kit.

Salt and pepper should be purchased in shaker tins, and sugar should be carried in tins. The same is true of flour, butter, and other foods which will be affected by moisture. Never start out with food in cardboard cartons or paper or cloth bags. The first wetting will spoil everything.

Experienced outfitters in the north country say that for two men on a two weeks' trip, or one man for a month, a good, well balanced food supply—making some allowance for fresh fish caught en route—should include:

Flour, 15 pounds; baking powder, ½ pound; pancake flour, 3 packages; crackers, if desired, 4 packages; cereals, 6 pounds; bacon, 5 pounds; canned meat, such as

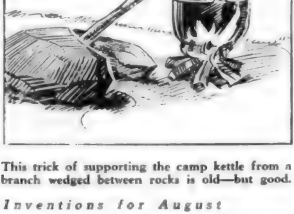
beef, 8 quart cans; eggs, 10 doz., or preferably the equivalent in egg powder: canned soup, 8 cans; fresh potatoes, 20 pounds, or equivalent of desiccated potatoes; fresh onions, 4 pounds; tomatoes, 4 cans; corn, 4 cans; beans, 4 cans, or better still their equivalent in dried beans; butter, 4 pounds in tins; lard, 3 pounds; sugar, 10 pounds; salt, 2 pounds; pepper, 1 can: coffee, 2 pounds; tea, 1 pound; milk powder, 4 pounds; maple syrup, 1 quart; fresh fruit, 30 portions; dried fruit, 5 pounds; sweet chocolate, 3 pounds.

That's a good, well-balanced ration for two men for a fortnight. If the trip is being made on bad water, with frequent and long portages, the bulk can be reduced by carrying more of the essentials and reducing the variety somewhat, or in good fishing country it may be reduced to allow for more fish.

Flat-soled boots with virtually no heel, as worn by the sportsman above, are best for use in the bush. At the left is demonstrated the proper use of headstrap in packing heavy loads.

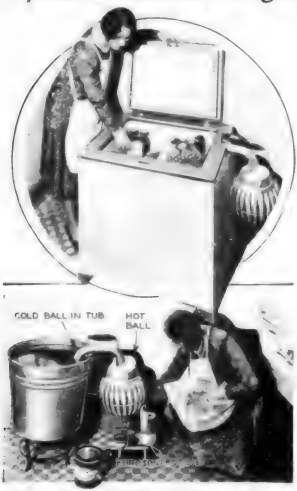
The gallon pail is the most useful piece of equipment. Water is carried and boiled in it and soups, tea and coffee are made in it. Carry a cake of paraffin and when you are in camp the pail comes a refrigerator. Put your butter tin and your fresh fish in the pail with a few rocks; close with the tight fitting lid and seal with melted wax. Attach a lanyard and a marker buoy and you can drop the bucket to the bottom of the stream. Fish will keep for a week in this way, and the butter will always be cold and hard.

If you are going on an automobile campaign trip I learned a trick, from the Canadians, who used it in France, that always insures a hot fire in any kind of weather, without hunting for dry wood. Scoop out a narrow "U" shaped trench—you can do it with your boot heel—shaping it like the mark an auto tire would make standing in soft mud. At the center it should be a couple of inches deeper than the height of a tomato can. Fill an empty can with gasoline, place it in the trench, and drop in a match. The gasoline can not explode, and you have an extremely hot fire that will burn for ten or fifteen minutes. You can place your kettle or frying pan directly on the ground over the trench. A small can of gasoline will boil a four-gallon tin of water in ten minutes.



This trick of supporting the camp kettle from a branch wedged between rocks is old—but good.

Icyball Is Practical Refrigerator for Farm or Camp Use



Heating of hot ball forces refrigerant into cold ball which is then placed inside the cabinet.

MAKING ice from heat at a cost of but two cents a day is one of the latest contributions of science for man's comfort, convenience and health. The Icyball refrigerator, which operates on this principle, does not require gas or electricity and can be used anywhere.

The operation of this new and unusual refrigerator is simple. There is nothing to get out of order, no moving parts and no odor. It is absolutely noiseless and requires no oiling. The refrigerant never needs replenishing.

The freezing unit consists of two metal balls joined together by a strong metal tube. These balls contain a harmless liquid refrigerant hermetically sealed inside.

Once every 24 hours it is necessary to lift the "Icyball" out of the cabinet, submerging the cold ball in a tub of water, allowing the hot ball to hang outside. The reservoir of the heating unit is filled with kerosene, the flame is lit and the heat soon forces the refrigerant into the cold ball. The "Icyball" is then placed back into the cabinet, and no further attention is necessary for 24 hours. The Icyball is ideal for use in rural homes where it is difficult to obtain ice.

Autos Main Cause of Accidents

THE automobile continues to be the most dangerous article in America. Inside the home, bathtubs and loose rugs on floors vie with each other for the doubtful distinction of being most dangerous to human life and limb. More people are injured inside homes themselves than in gardens, farmyards or otherwise around the home. More than twice as many people are injured when riding in automobiles than as pedestrians.

In seriousness of injuries as measured by the money value of claims for accident insurance, automobile injuries again are far in the lead, being more than twice as costly on the average as injuries at home or to pedestrians and about one-fourth more costly than injuries to travelers. Among the causes of injuries by automobiles, collisions with other automobiles holds first place, accounting for 1572 injuries in 1929.

A Tractor With Concrete Wheels

TO ADD weight for rolling driveways and tennis courts, a Pasadena contractor has equipped his tractor with massive concrete wheels. Special wide rims were laid on the ground, the wheels set in them, accurately centered, and the concrete poured over the spokes until flush with the rims. Openings in the center permit access to hub caps. These wheels are removable.

To facilitate rolling operations, this tractor is equipped with special steel-tired concrete wheels.

New Cameraman's "Gun" Fires Flash and Clicks Shutter

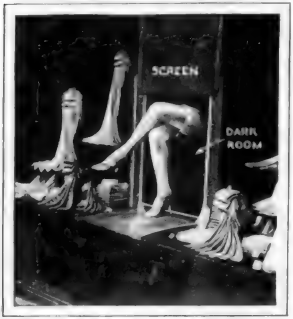
MANY a time photographers have sworn violently when their flashlight powders failed to ignite at a critical moment; but such annoying accidents need no longer occur if the new photographer's flash gun shown at the right is put to use.

The "gun," recently placed on the market, is built on the principle of the flash signal gun used in the army. The flash powder is carried in a cartridge sealed from wind and rain. At the same moment the flash powder is set off the shutter is released, thus timing the flash to the moment of exposure.

Photographer's gun fires off cartridges of flash powder and operates the shutter simultaneously.

Novel Hose Display Draws Crowds

ALMOST unusual means of advertising silk hose, being used by a department store in Berlin, is shown in the photo below. A young lady sits in the window wearing stockings with only her legs exposed. The store reports that curiosity to see the woman's face brings hundreds of people inside, thus making better business.



Silk hose window display of a Berlin merchant.

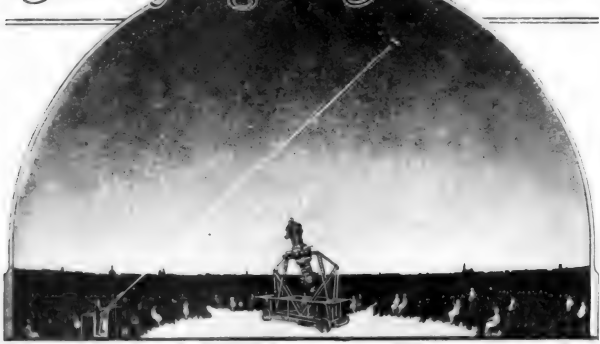
67 Years to Map U. S. Completely

UNCLE SAM has been mapping his country for 49 years and he isn't near through. Begun in 1881 by the U. S. Coast and Geodetic Survey, the work will require 18 more years. President Hoover is behind the task, laying out the program.

Roofing Cutter Has Extra Blades

AN EFFICIENT and handy device for breaking or cutting linoleum and roofing is illustrated below. The breaking edge is fixed onto the handle and is used to crease the roofing before cutting. For cutting, detachable double hook blades which are screwed to the breaker are used. The blades dull quickly and have to be changed often. In the hollow handle additional blades can be kept for renewal. The device is being patented for placing on the market in the near future. Dan Laub, of Minneapolis, is the inventor.

Studying the STARS in



With a flashlight beam for a pointer, the lecturer in Chicago's new planetarium points to a star cluster displayed on a linen sky by the Zeiss projector, the only one of its kind in America.

by ROY DEAN

One of the most unusual buildings in America has just been opened in Chicago. On a huge linen sky a remarkable projecting machine will recreate the heavens, showing 6000 stars in their places and illustrating the movements of the planets and satellites in their orbits.

SIX thousand stars wheeling overhead, their movements through space for a day, or even a year, compressed into a minute, will be the spectacle for visitors to Chicago's new planetarium—the first in America—which has just been opened.

A weird projecting machine looking like an enormous dumb-bell grasped in a huge mechanical fist and mounted on a traveling carriage of heavy steel, throws the images of the stars on a vast dome sky, sixty-eight feet in diameter and rising fifty-two and a half feet above the floor. Eight hundred square yards of linen, stretched taut over a hidden steel framework, comprises the sky.

The instrument, developed in the Carl Zeiss laboratories at Jena, has entertained and instructed millions abroad, where eight are already installed in German cities and a ninth in Vienna. In one year more than 140,000 visitors attended lectures in the original planetarium at Jena, a town of 55,000 inhabitants.

The Chicago planetarium is a gift of Max Adler, a local millionaire, who provided $700,000 for the building and instrument, and a collection of 500 ancient astronomical instruments, including gold, silver and bronze engraved globes, sun dials, hour glasses, telescopes and astrolabes. The collection, gathered by Strozzi, of Florence, Italy, and sold after the war to the Mensing firm of Amsterdam, cost more than $50,000. The planetarium has been built on an artificial island in Lake Michigan, and forms part of an educational and entertainment group including the great Field Museum of Natural History, Shedd Aquarium, and Soldier's Field, the huge stadium which has accommodated audiences as great as 260,000 people, and held more than 110,000 for a football game.

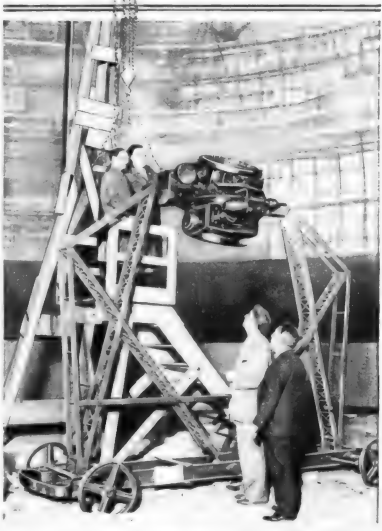
Chicago's Planetarium

The building, of rainbow granite from St. Cloud, Minn., is surmounted by a copper dome 82 feet in diameter. Within, and suspended from the outer dome, is an inner one 68 feet across, supporting the linen sky. Around the central dome are grouped exhibition halls for the ancient instruments, cloak rooms and offices.

The planetarium projector has 119 lenses, through which the star images are projected from lantern slides. Dr. Philip Fox, who resigned his position of professor of astronomy at Northwestern University to become the director of the planetarium, has arranged with the Zeiss company to build additional attachments which will enable the machine to show special slides of new comets and other astronomical happenings as they are reported from time to time in the newspapers.

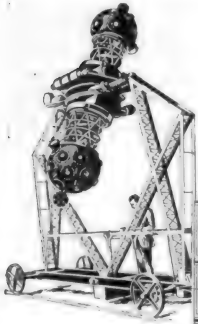
The balls at the end of the dumb-bell-like projector house the lights and lenses for the fixed stars in each of the hemispheres. The central mechanism takes care of the sun, moon and the planets, while the rotation of the instrument provides for the apparent movement of the stars as the earth rotates, and also makes it possible to speed up that movement to any desired pace. For example, the movement of the north pole star through its orbit, a process that takes 26,000 years, can be shown in one minute, by cutting out the planetary motors. If the planetary motion is kept in gear it would take about 36 hours to show the 26,000 year cycle.

The machine also can be set to show the heavens at any given date in the past or future. For example, it can be made to reproduce the stars as Columbus saw them, or going farther back, can show the heavens that the Roman astrologer read the night before Caesar was murdered. Or again, the conjunction of the planets that produced the bright star over Bethlehem the night the Christ child was born can be shown at will.



The frame and central section of the projector being installed inside the partly completed planetarium building. The steel framework visible in the background will be covered with linen to form a sky canopy on which stars, planets, nebulae, and other astronomical phenomena can be projected electrically.

Inside the planetarium building the wall has been painted with the skyline of a city in which tops of buildings give a natural appearance to the horizon. Seats are provided around the projector for the spectators. The lecturer stands on a platform and controls the movements of the projector from an elaborate switchboard placed in front of him. To call attention to particular



The projector set to reproduce the sky as it appears from the north pole. The projector can be set to reproduce the sky for the spectators as it appears from any point on earth.

stars he uses a flashlight beam as a pointer. Through speeding up the projector and showing planets and satellites traveling across the sky in their appointed orbits, the machine is able to present in a graphic, visible way a picture which months of study of diagrams and descriptions could not equal.

Mechanical construction of the Zeiss projector is marvelously intricate, as may be gathered from the fact that it cost $90,000 and required the services of 100 skilled workmen for nine months in its building. An example of the complicated construction can be seen in the drawing of the mechanism for projecting the planets, as reproduced on this page. Lights representing Venus, Mercury, Jupiter, and sister planets move about on a series of eccentric disks so that they are projected in their true orbits. A single shaft driven by a motor operates the whole planet mechanism.

Since the projector rotates on its axis, electric wire connections are made through circular contact points which permit free rotation.

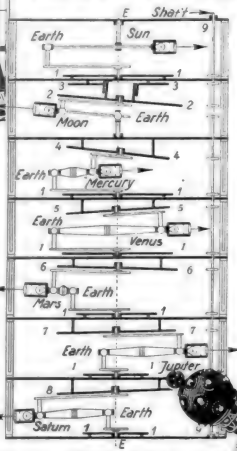
A much appreciated advantage of the planetarium is that it permits one to study sections of the sky he has never seen. For instance, a dweller in the northern hemisphere may never see the Southern Cross, but the planetarium will show him this feature of the southern skies. Likewise, when a new planet swims into the sea of astronomical knowledge, as occurred only recently, special slides showing its position in relation to other stars, its relative brightness, and its probable orbit, help the layman to understand significance of the discovery.

The photo on page 99 shows a side elevation of the Zeiss planetarium from the north with the machine set to show the aspect of the heavens from the North Pole of the earth. Its parts are disposed as follows:

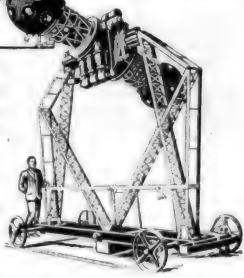
1-1—Polar axis, perpendicular to the terrestrial equator.

2-2—Axis of the ecliptic, perpendicular to the plane of the earth's orbit.

3-3—Axis for varying the geographical latitude, around which all the projection apparatus revolves so that the audience can see the sky as it



Apparatus for reproducing movements of planets and the earth's moon. The shaft at the right operates all the disks which control the movements of lights representing the planets.



Here the projector is set to reproduce the sky as seen from equator.

appears from any point on the earth's surface.

4-4—Thirty-two projectors, distributed over the two star carriers, one for the northern sky and one for the southern, for the representation of 5,400 fixed stars.

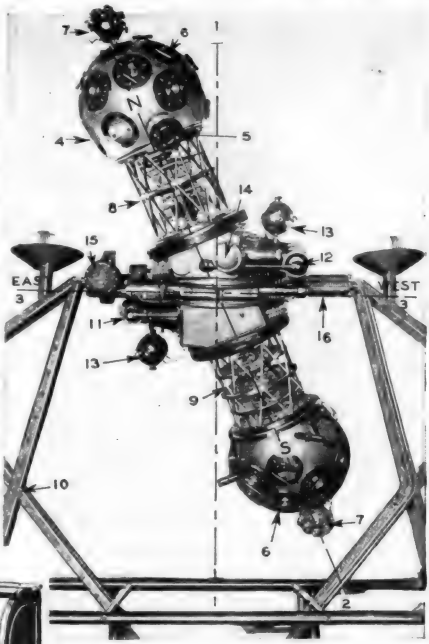
5—Projector for the Milky Way; similar projector is not visible on the southern hemisphere.

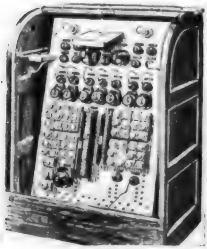
6-6—Eighteen projectors for nebulae, star clusters, and the brightest star, Sirius, the dog star.

7-7—Thirty-two projectors for constellation names and the circle described by the pole in consequence of the gyroscopic motion of the earth.

8—Ten projectors and the mechanisms for the sun, its halo, the Moon, Saturn, and the Zodiacal Light.

9—Eight projectors and the mechanisms for Mercury, Venus, Mars and Jupiter.





Switchboard used by the planetarium lecturer. The keys enable him to control the projector. Note the great number of switches.

10—Frame.

11—Two motors for the diurnal motion, a day in 1, 2, 3 or 4 minutes.

12—Three motors for the annual motion, a year in 7.3 seconds or 1, 3, 4 or 7 minutes.

13-13—Twelve projectors for the central lines of the Zodiac (ecliptic) and the celestial equator, the north and south polar points.

14—One motor for the gyroscopic motion of the earth, 26,000 years in 4 minutes.

15—One motor for the rotation about the axis 3-3 to produce variation in geographical latitude.

16—Contact points to connect fixed electrical wires with the rotating parts.

PLANE TALK

Edited by MAJ. H. H. ARNOLD

The editor of this department is nationally prominent in the field of aviation, having been assistant chief of the Army Air Corps during the World war. His comment on new developments in aviation is a monthly feature of Modern Mechanics.

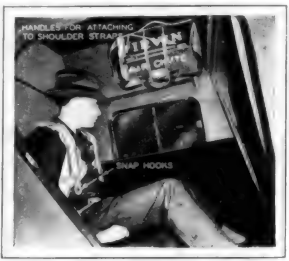
Eye Defects Which No Flyer or Motorist Should Have

FOUR types of eye defects which make their owners public menaces when driving automobiles were recently listed by Dr. Alfred Salter, medical member of the House of Parliament, in which he urged against the issuance of driver's licenses to such people. Inasmuch as these eye defects are even more serious when suffered by an individual who wants to pilot an airplane, a brief listing of them is not out of place here.

Two of the defects are well known. One is extreme shortsightedness, in which the individual cannot see objects clearly for some distance ahead of him. Another is color blindness, making difficult or impossible the recognition of colored signals. A lesser-known defect is night blindness, an eye condition in which it is difficult to see clearly after dark. A night-blind person can see satisfactorily in the daytime, but should never be allowed to drive after dark. The last defect in Dr. Salter's list is the progressive deterioration of the eye not uncommon in older people in which the field of vision grows narrower so that nothing is seen clearly unless the eyes look straight at it. To such persons objects at one side, such as cars approaching from side streets or airplanes coming from the side, are totally invisible until they are so close that an accident is unavoidable.

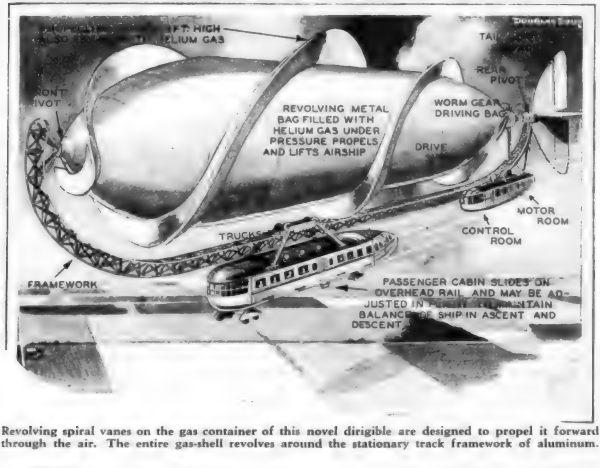
"Quick Connector" Air Chute

IN some kinds of airplanes and dirigibles where the accommodations are crowded, parachutes cannot be comfortably and conveniently worn by passengers. To provide a safety device for use in such planes, a new parachute known as the "Quick Connector" has been designed by the Irvin Company. With this chute the passenger wears only a comfortable harness around his shoulders while in flight. In case of emergency, the air chute, which is carried separately on the wall, can be hooked to snap fasteners on the harness and it is ready for use. Two snap fasteners are provided, but the chute will operate just as well if only one fastener is connected, except for some discomfort in descent.



In case of emergency, the chute hanging on the wall can be snapped onto the passenger's harness.

Proposed Rotary "Aero-Zep" Uses Novel Screw Vanes



Revolving spiral vanes on the gas container of this novel dirigible are designed to propel it forward through the air. The entire gas-shell revolves around the stationary track framework of aluminum.

ALMOST unusual type of dirigible involving wide departures from established principles has recently been patented by two South Dakota inventors. They call it the "Rotary Aero-Zep," and aside from the fact that the entire craft is designed to be constructed of aluminum, the most novel feature of the invention is the metal gas bag which is designed to revolve around the frame trackway carrying the passenger car, screwing the airship forward in the air through the action of spiral vanes mounted on the side of the bag.

These vanes, three feet in height, are V-shaped and hollow, and are themselves filled with helium separately from the gas bag. The passenger cabin is suspended from a track running beneath the ship, being mounted on trucks which are free to move along the track to keep the weight of the ship balanced as the angle of ascent or descent varies. The track framework, curving upward at either end, supports pivots on which the bag turns freely. To call the gas container a bag is somewhat of a misnomer, since it is to be of corrugated aluminum.

A motor cabin, mounted permanently at the rear of the trackway, contains engines which will drive the revolving bag. Tail control surfaces are of conventional design, except that each of the four sections is separately controllable—that is, the right half of the elevators can be controlled independently of the left, and the top section of the rudder independently of the bottom, in contrast with usual practice in which both sections of rudder or elevator are operated together.

Seven hundred miles an hour is the rather incredible speed anticipated from the craft by its inventors, Rev. Carl H. Loock and Lorrin L. Hansen of Rapid City, South Dakota. The bag itself, through its novel drive, will revolve comparatively slowly even when the ship is traveling at top speed, the inventors believe. A safety valve at the end of the body is provided in case gas pressures are built up to a dangerous degree. As yet this amazing new idea in aeronautics has not progressed beyond the model stage, and it is not at present known when a full size ship will be built.

Romance of Plane Insignia

Planes from Bolling Field, Washington, D. C., appropriate to their location at the seat of the national government, use for their identifying insignia the capitol of the U. S. At right—The 3rd Attack Group of Galveston, Texas, adopts a coat of arms as its squadron insignia.

Above—A dusky cupid—or, more probably, a grinning black imp—directs an arrow at the enemy to symbolize the swiftness of the Kelly Field Attack section. At right—White bones, red blood dripping from the scythe, make up this striking emblem of 13th Attack Squadron, Galveston, Texas.

The devil, a bomb in his hand, expresses his contempt for the enemy in the insignia of the 9th Bombardment Squadron, San Diego, Calif.

DURING the World war the various fighting squadrons of the Air Service adopted the policy of painting insignia on their airplanes. These insignia reflected the experiences of the pilots or of the squadron in war, or perhaps had no significance other than that which the original design itself intended to convey. The squadrons of the United States Air Corps have, as far as possible, continued in peace the same insignia as were used during the World war.

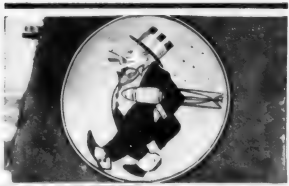
Insignia, besides promoting an *esprit de corps* provides a means of identifying the planes of a particular squadron. At the Air Corps maneuvers held at Mather Field, California, this spring, squadrons were assembled from all parts of the United States; Pursuit from San Diego and Detroit; Attack from Galveston; Bombardment from Langley, Va., and Observation from San Francisco. The insignia of the various units, to those who were not abroad in 1917-18, represented considerable imagination and initiative in their preparation, but to those who served in Air Units during the war they awoke memories of the past and brought forth many reminiscences.

The insignia of the *Ninety-First Observation Squadron*, apparently taken from the magazine "Life," was drawn up in 1917 in France, and shows a mounted knight chasing the devil. This insignia is highly colored and makes a striking identification mark on an airplane.

In the insignia of the *90th Attack Squadron* the originator, one might be led to believe, was a devotee of the goddess of luck, as he had used a pair of dice with the total of "7" showing on the sides, to identify his unit. This insignia became famous throughout the United States when Jimmy Doolittle was making his record-breaking trans-continental flights. He invariably carried it on his planes.

Dates from World War Days

The *13th Attack Squadron* has a very striking insignia, woven around Death swinging his scythe. The figure "13" on this emblem is composed of skulls and bones. In the original insignia, used during the World war, the scythe had nicks on it, one for each victory by a member of the 13th Squadron, over a Hun airplane. At the bottom of the insignia were little tombstones in the shape of crosses to indicate the number of victories by the Squadron.

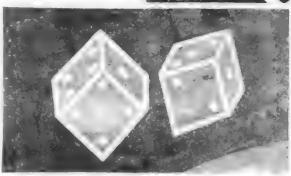


Above—Jiggs of cartoon fame obviously means business with a bomb under his arm. The insignia identifies the 11th Bombardment Squadron, Langley Field, Va.
At left—The American Indian. The design is that of the 94th Pursuit Squadron, Selfridge Field, Mich.

The *11th Bombardment Group* has, too, an outstanding insignia, with the humorous element predominating. It shows Mr. Jiggs, the well-known cartoon character, carrying a bomb under his arm—evidently for the purpose of hurling it at Maggie at the first available opportunity!

In the insignia of the *20th Bombardment Squadron* we have a pirate about to hurl a bomb through space. The emblem was, apparently, originated during the time this squadron was in Panama, and has been continued since the organization returned to the United States.

A mule crouching in a position to deliver a "double barrelled" blow, at the slightest provocation is the picture that identifies the *95th Pursuit Squadron*. The idea of the wallop from the heels of the mule developed in France after one of the squadron had brought down several Huns.



Above—A mounted knight has enemy forces on the run in this unique insignia of the 91st Squadron, Crissy Field, San Francisco, Calif.
At left—Good luck as represented by the dice is augured by the insignia of the 90th Attack Squadron, Galveston, Texas.

The *17th and 27th Pursuit Squadrons* very appropriately adopted as insignia birds diving through space on their prey. The 17th Squadron used the White Owl and the 27th the Falcon, both depicting the bullet-like drop through space when the aerial attack is driven home. Birds have always been popular in designating airplanes.

One of the best insignia seen at the maneuvers was that of the *489th Pursuit Squadron*, which depicts a puppy being given chase by a wasp which clings persistently to the end of the dog's stubby tail.

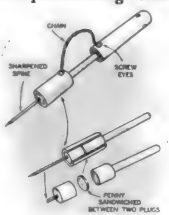
The inference of this insignia seems to be that things are due to happen when the 95th Pursuit Squadron of San Diego, Calif., gets on the job.

HANDIKINKS

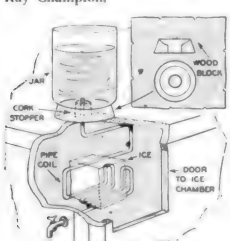
In these pages you will find ideas which you can make use of to advantage in your own home—ideas which will save time or labor or add to the convenience of the household. All these projects can be worked out with simple tools and usually require only a few minutes.

Bamboo Pick Cracks Off Chunks of Ice Without Splintering Cake

AN ICE pick that will crack off a large chunk of ice from the block without getting splinters all over the floor can be made from a couple of pieces of bamboo, about an inch and a half in diameter. Two sections, one about four inches long and the other half that length, are hollowed out and the end of the longer piece securely plugged. A sharpened spike is driven into a pine plug to fit into the smaller bamboo, and the tip filed down. Whittle a plunger to slide inside the larger tube. Sandwich a penny between the two plugs as shown to act as a stopper for the nail. Connect the two parts and secure with a length of chain. To operate, bring the large piece smartly against the one containing the pick.—Ray Champion.



Ice-Box Water Cooler



ICE water can be obtained by merely opening a faucet when the household refrigerator is equipped with the cooling device shown at the left. A 12-foot length of ½-inch copper or brass pipe is coiled in the ice chamber as shown, the ice block resting upon it. The top of the coil runs through a hole drilled in the top of the refrigerator and the other end terminates in a faucet. A glass bottle of gallon size or larger is used as the water container, being inverted in a wood block which can be turned in a lathe to fit, or gouged out with a chisel.—Herman R. Wallin.

Painted Socket Grooves Easily Located

PLACING the two parts of an electric socket connection together is not always an easily accomplished task, particularly when the socket is in a dark corner. The job can be made easier if you will cut two grooves into the receiving half of the socket, parallel with the openings, and paint them white. The grooves are easily visible in subdued light, making insertion of the connecting prongs easy.—R. Wailes.

Kinks for the Home

Wood Embossing With a Nail

AN ORDINARY wire nail and a hammer are the only tools needed to produce pleasing wood embossed designs like those shown in the drawing at the right. Saw the point off the nail so that it is flat across the end. Then, with a small triangular file, cut two grooves across this end at right angles, to produce four teeth on the point as shown.

Mark out the design to be embossed on the work with a pencil and use the embossing tool as shown, holding the nail upright and tapping it gently with a hammer. Follow the edges of the design carefully. The points of the nail pack down and stipple the wood in a pleasing pattern. Depth of the embossing is, of course, dependent on how hard a hammer blow is used. The embossed surface must be kept as level and even as possible. Attractive effects can be obtained with some designs by staining the embossed portion with burnt umber or wood stain, done before the finished work is varnished.—Harold Jackson.

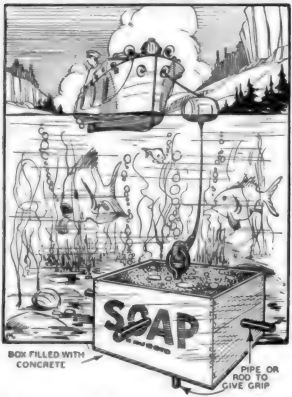
Cork Support Makes Table Legs Solid on Uneven Floors

TABLES sometimes refuse to stand with all feet firmly on the floor, due either to a warping of the leg or to unevenness in the floor. The usual method of correcting this unbalanced footing is to force a wedge between the floor and the short leg, but this is not entirely satisfactory either from the score of neatness or efficiency, since it is easily dislodged if the table is moved about slightly. A more satisfactory method is to drill a hole in the bottom of the short leg into which an ordinary cork is forced until all the legs set evenly. The cork not only holds the table level, but presents a non-skid surface to the floor which prevents marring the varnish. It may sometimes be necessary to treat a second leg in the same fashion if the floor is extremely uneven.—Walter Sehm.

Socket for Gate-Leg Tables Prevents Leaf Collapsing

IF THE leg of a gate-leg table is accidentally swung shut when the leaf is up, the leaf immediately falls and if there has been a bowl of soup or some other dinner article on it, the results are embarrassing. To prevent such a catastrophe, fit the table with a safety device as illustrated in the drawing at the right. A nail is driven into the top of the gate leg and its head is left extending about three-eighths of an inch. The head is then filed off, leaving a short metal pin. Now open up the gate, mark where the pin comes under the leaf, and bore a socket for it about half an inch deep.—John Edwin Hogg.

For the Camper and Woodsman



Soap Box Cement Anchor

BOATMEN will welcome the serviceable, inexpensive anchor shown in use in the drawing at the left. It consists simply of a soap box, or similar small wooden box which your grocer will be glad to give you, through which two pieces of metal pipe or rod are run at right angles, piercing the sides and projecting for three or four inches. The eye to which the anchor rope is attached is then put in place, passing through the bottom of the box. Now you are ready to pour the cement. If you can get hold of some boiler punchings or other bits of small scrap iron, mix them with the cement to add weight. The average anchor made in this way will weigh better than 200 pounds. The rods extending on all sides prevent the anchor from sliding over the lake bottom, and serve the additional purpose of hand grips. The amount of cement required is small—merely enough to bind the elements together—T. S. Asgaard.

Waterproof Fishing Data List and Tackle Container

GAME laws of most states prescribe certain lengths for fish which the angler may legally catch. For a person who does not fish enough to be familiar with the various length limits, a waterproof list containing the desired information is almost necessary. The drawing at the right shows a handy method of carrying such a list, in which the information is written on a long card which is inserted through the neck of a wide-mouthed jar. Natural springiness keeps it tight against the jar walls.—Lester P. Young.

Tire Chains Hold Tent Flaps in Place

ANYONE who has occasion to use a tent for overnight sleeping purposes will find the idea illustrated at the left useful when the wind is high. Take the tire chains from the car and pin them along the lower edge of the front tent flaps with heavy safety pins.—Iva Belle Allan.

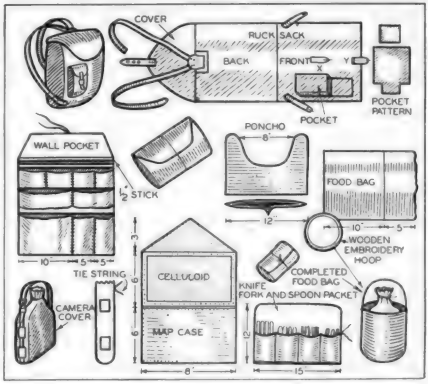
Stunt to Help You Catch More Fish

A NOVEL method of enticing pike to bite was recently demonstrated by an old fisherman who had his line out from shore and who was kept busy hauling in fish while others nearby were having no luck at all. At intervals of about a minute he tossed a small pebble toward the cork float of his line, and the disturbance in the water attracted the fish who, being hungry, snapped up the minnow on the end of the hook.—Ray Champion.

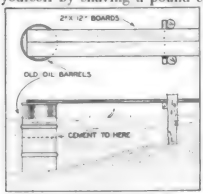
For the Outdoor Sportsman

Balloon Silk for Camp Use

BALLOON silk is really a closely woven Egyptian cotton fabric which sheds water well and stands hard wear. If you cannot procure balloon silk, or a slightly heavier fabric known as sailcloth, write to MODERN MECHANICS and the address of a supply house will be sent you. Patterns for a complete outfit of camp equipment to be made from this fabric are presented in the drawing at the right. All the items are simple to make and can be fabricated on the home sewing machine, using the largest size needle and No. 40 linen thread.



After making each item it can be dyed tan or green or some appropriate shade, and then waterproofed. You can do this yourself by shaving a pound cake of household paraffin into a gallon jar. Fill it to the top with gasoline and set it in the sun or a tub of hot water to melt—*never* near a flame. The solution then can be painted on the article and the fabric hung out to allow the gasoline to evaporate.—C. Fordyce.

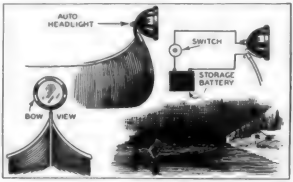


Oil Barrel Makes Good Pier Crib for Dock

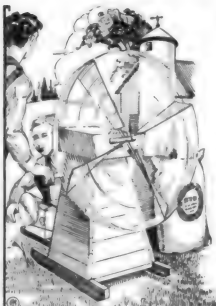
SUMMER cottagers who can procure an empty oil barrel will find it an excellent piece of equipment for building docks. An empty barrel is filled about half way with cement and rolled out into the lake where the end of the dock is to be. All that remains then is to extend the planking to rest on the barrel, driving a stake on either side with a crosspiece to steady the dock. With a sufficient weight of cement in the barrel it will resist the buffeting of waves and storms.—Theodore Allen.

Auto Headlight for a Canoe

AN AUTO headlight, wired to the prow of a canoe and connected with a six-volt storage battery, is a handy accessory which will prove very useful in enabling the canoeist to make landings and avoid obstructions in the water. A headlight can be purchased cheaply from any auto junk yard, and a serviceable storage battery can usually be obtained from the same source. —Helen Morley Collins.

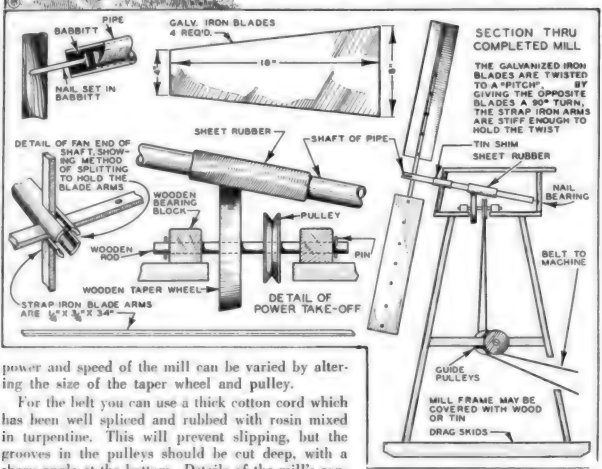


A Small Power Windmill



A SMALL power windmill for operating toys and small pieces of machinery can be made from the complete plans presented herewith at a minimum of expense. Essentially, the mill consists of the following: A wheel carrying four blades, attached to the end of a pipe running through the mill frame at a slight angle, containing at its further end a large nail embedded in babbitt whose smoothed-down point fits into an oil-soaked hole in the side wall.

Most unusual is the power drive. A wooden wheel, tapered to conform to the shaft angle, is mounted on a small hardwood rod which also carries a grooved pulley for the belt. Two other grooved pulleys are mounted in the frame as shown, permitting the belt to turn at right angles so that a machine can be operated some distance away. The drive shaft is wound around with rubber where it contacts with the tapered wheel, a section of an old inner tube being adequate. Relation between

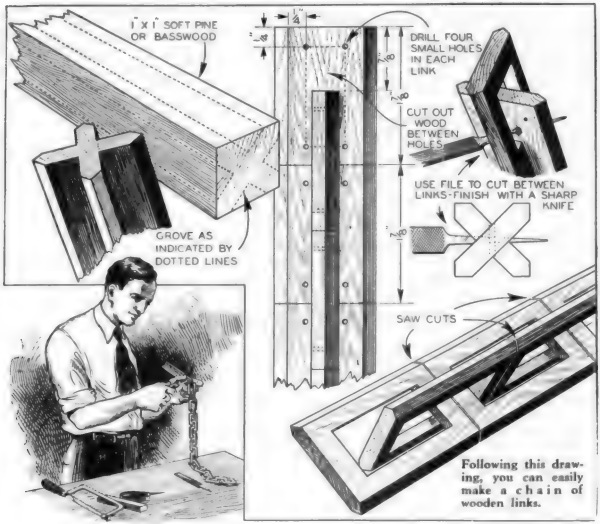


power and speed of the mill can be varied by altering the size of the taper wheel and pulley.

For the belt you can use a thick cotton cord which has been well spliced and rubbed with rosin mixed in turpentine. This will prevent slipping, but the grooves in the pulleys should be cut deep, with a sharp angle at the bottom. Details of the mill's construction can readily be understood from the drawing, and dimensions can be varied according to your purposes. A surprising amount of power, often as much as a quarter horse, is developed by this little mill in a moderately stiff breeze.

Built according to the above drawing, this windmill will develop from an eighth to a quarter horsepower in a 30-mile wind. The whole mill is turned to face the wind. If its own weight will not keep it steady, it can be staked down.

Cutting Chains of Wood



Following this drawing, you can easily make a chain of wooden links.

CHAINS constructed of unbroken links of wood are easily made and require no special tools or skill on the part of the workman. Such chains usually cause considerable pondering over the method of construction on the part of those who aren't in on the secret, but as the above drawing shows, the method is really quite simple. A sharp knife, a six-inch file, and a hacksaw are the only tools required.

Soft wood such as pine or basswood makes a good chain. Chances of splitting are lessened by securing straight-grained wood, thoroughly seasoned. First dress it down to 1"x1". The completed chain will be approximately a half-inch per link longer than the original stock. The next step is grooving the wood as indicated by dotted lines in the drawing, so that an end view will show it in the form of an X. Two alternate sides are then trimmed down 7/8" from the top. Next, allowing 1 7/8" for the length limit of the link, drill four holes 1/4" from the edges at the four corners of the link. These holes are then joined with knife cuts and the intervening wood removed, leaving the top half of what is to be the second link projecting through the first.

Repeat this operation, details of which will be made clear by a study of the drawing. In joining the four holes, first connect the two holes on the sides, and then connect them crosswise. When the links have all been cut, the two sections of what was originally one piece of wood will move independently of each other. All that remains is to saw apart the links and finish them up with knife and sandpaper. A bit of practice, of course, will enable you to improve on the quality of your chains.

Taking Photos from the AIR

This air photo of a dirigible hangar shows that good results are obtainable with a small camera.

by WALTER E. BURTON

HOW to use a camera in the air is one of the little problems that almost everyone who makes a trip by airplane faces. Nearly everybody has a camera, and the natural inclination is to use it to obtain souvenirs of an air voyage. There are, too, many commercial photographers who are called on to make air pictures, and who, nine times out of ten, are as much puzzled as the rankest amateur.

The first and most prevalent illusion seems to be that the making of an air picture is just like taking one on the ground. It isn't. When shooting from the air, you have to contend with the speed and vibration of the plane, changing light conditions caused by moving clouds, and, most vital of all, aerial haze which has done more to ruin air pictures than anything else. Of course, you have haze on the ground, but you usually are taking pictures in such a manner that it does not act as a sort of reflector for sunlight coming from above.

As airplanes travel at fairly high speeds, and often vibrate considerably, it is imperative that both rapid films and lenses and fast shutters be used. This means that the speed of the lens should not be less than f:4.5 and the shutter speed in the neighborhood of 1/150 second, for average conditions. In the tropics and other places where there is abundant light, slower lenses will give good results, but the shutter speed cannot be lowered appreciably because of vibration.

Before embarking on a journey in an open-cockpit plane — preferably the rear cockpit—you must give your camera some attention. The pressure of a wind of 90 miles or more velocity will make short work

Proper Method of Holding Camera Is Vital for Successful Air Photos

A wooden frame for a folding camera like the one shown prevents the bellows being ripped off by the great speed of an airplane. Photo in background above shows how haze, invisible to the eye, results in foggy air pictures unless precautions are taken as explained on these pages.

of the camera bellows, unless it is protected. You can construct a special shield of wood or metal.

Water vapor and other foreign particles in the atmosphere serve to scatter the violet and blue light, creating aerial haze that obscures ground details both to the eye and the camera. In order to remove the effects of this haze, filters that hold back the blue and violet are used.

Panchromatic film is almost necessary if really good air pictures are to be made. It is sensitive to all colors of light, including red, and therefore must be handled in total darkness or by the light of a special green safety lamp.

Equipped with your filter, the proper film, and a bellows shield, you are almost ready to start. There remains one important thing: Tie your camera to your wrist with a stout strap or cord, so that it will not be lost if it is blown out of your hands—a not uncommon occurrence.

When you are ready to make the exposure, set the focus to infinity, the shutter speed to 1/125th second or less, and the lens diaphragm to the largest opening, unless the light is extremely bright. Then, holding the camera so that it is supported only by your hands and arms, and does not touch any part of the plane or your body, take the picture.

Two methods of holding small cameras for taking air photos. Only the hands and arms are used to support the camera. They act as shock absorbers between camera and vibrating plane.

200-Mile Air Camera

New York as it appears to the camera shown in inset thirty miles away from a height of 22,000 ft.

A LONG distance aerial camera perfected by Captain A. W. Stevens of the U. S. Army Air Service has proved itself capable of taking photographs from a distance of 200 miles. The secret of the amazing performance of the camera lies in the fact that it is equipped with a dense red filter that cuts through the haze which usually clouds long distance pictures. The above photo of New York shows how the smoke which always hangs over a large city is pierced.

A Cross-Channel Gliding Prize

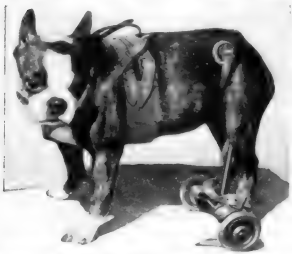
A PRIZE of $5,000 for the first person to cross the English Channel in a motorless glider has been posted with the British Gliding Association by A. J. A. Barr on behalf of Cellon Ltd. The glider must be all-British and the flight must be made before May 31, 1932. Mr. Barr has also offered a prize of $250 for the first flight of 50 miles in a straight line.

Novices Make Signs With New Showcard Writing Device

SHOWCARD writing has in the past been a trade carried on by professionals with an ability to lay out the sign and do lettering gained from years of experience. However, with the new show card writing device which has recently been placed on the market, novices are enabled to lay out and letter signs as well ordered and neat as work done by experienced men. The device, shown at the right, is a real sight writer and is very simple and easy to manipulate. All previous lines are in sight and no guessing for position is required. Signs of any required size can be made as well as streamers of any desired length or width.

Size and position of letters laid out with this writing device.

Crippled Dog Walks With Skates



Skatewheels on the truss around this crippled Boston Bull's body enables it to walk easily.

WHEN "Lady Lou," the Boston Bull pet of a lady in Kansas City, was hit by a speeding motor car and partially paralyzed, it was thought that she would have to spend the rest of her life as a sedentary invalid. Her owner, however, brought her ingenuity into play and devised for her pet a wheel chair, as shown in the photo above. Two rubber tired ball bearing skates were built onto a truss made to fit the canine's body and now, despite her handicap, "Lady Lou" is able to get around with surprising ease.

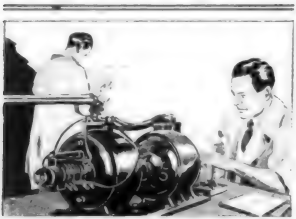
Burnishing to Replace Lacquers

AN AGE of rustless metals has been predicted by eminent scientists as the result of experiments with the now commonly used stainless steel. The automobiles of the future may go without coatings of paint, enamel or lacquer, using instead a metal finished only by a scientific process of burnishing. Sheet metals will be given contrast value in brilliancy to replace the rainbow colorings for which the lacquers and paint finishes now are used.

Music While Walking With Radio

A BERLIN engineer has invented a new radio hat set which may be worn without inconvenience to the wearer. With this set, shown at the right, one may listen to the Sunday sermon while motoring or playing golf, get the stock market returns at the ball game, or get the benefit of the daily dozen while on the way to work by merely tuning in.

AMATEUR ELECTRICIAN

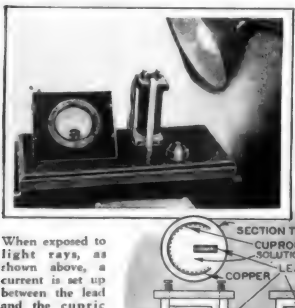


Edited by THEODORE ALLEN

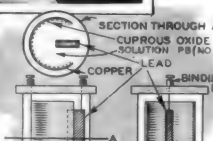
The mysterious and invisible force known as electricity has always been a source of fascination to those with the itch of curiosity. The practical uses to which electricity can be put are endless. In this month's issue of Modern Mechanics, Mr. Allen presents practical and experimental projects which you can easily carry out in your own workshop.

Small Chemical Cell Makes "Eye" to Detect Light Rays

A "CHEMICAL EYE" which is highly sensitive to light rays and which operates along lines similar to the now widely used "Electrical Eye" can be easily made by experimenters with a few chemicals and metals whose total cost is negligible. It can be used for a number of purposes such as opening and closing relay circuits, detecting thieves, and counting and sorting objects.



When exposed to light rays, as shown above, a current is set up between the lead and the cupric oxide-coated copper plate of the cell, causing the hand of the meter which is connected across the cell to swing across the dial.



The heart of this supersensitive "eye" is a cell of chemicals reacting on copper and lead plates, transforming light energy directly into electricity, which operates a sensitive indicating meter hooked across the cell. The "eye" differs radically from other photo electric eyes in that it requires no amplifying tubes.

The cell consists of a copper plate coated with a film of cuprous oxide (Cu_2O), and a second smaller plate of lead, both of which are immersed in a dilute solution of lead nitrate, as shown in the diagram below.

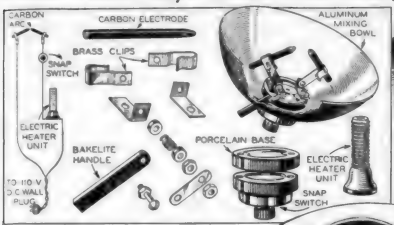
When exposed to light, the cuprous oxide of the cell changes to cupric oxide (CuO) and a potential difference is set up between the metal plates. This current is registered on the sensitive meter, shown in the photo at the left.

When the light source is again cut off, the cupric oxide goes back again into its original cuprous form and the potential likewise diminishes. In testing the sensitivity of the "eye," two sheets of white paper were brought before it, both sheets appearing equally white to the human eye — the "chemical eye" showed flaws in one.

Earth Currents Bring Rest

PEOPLE sleep more soundly at night than day because of the earth's electrical polarity, is the belief of an eminent scientist. Daytime is positive, night negative; and negative current is static.

Ultra-Violet Rays From This Easily Made Arc Light



This home-made arc light can be made with the above parts, using the circuit at left above. The lamp is mounted on a folding light stand and produces ultra-violet rays or photo light, as desired.

A SMALL portable arc light can be made to serve many useful and healthful purposes. For the photographer, it provides an intense illumination for making interior exposures. And the nature of the arc rays are such that they can be used for giving artificial sunlight baths which are becoming so popular. The arc can also be housed in a metal case and used in a magic lantern or small movie projector.

The building of such a lamp is an extremely simple matter. Furthermore, the cost of the lamp like the one described here is small and can be operated at a cost no greater than that of an electric iron. The total cost amounts to about $5.20, and is comparable to one costing $15.00 or more already built.

The entire light is mounted on a nickel-plated folding light stand that can be obtained at photo equipment dealers.

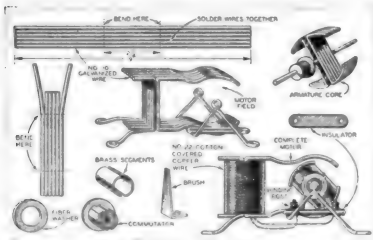
First procure an old switch and strip it of all metal parts, leaving only the base. This base is mounted on the inside of the aluminum mixing bowl and bolted through it onto a regular snap switch mounted on the rear, or bottom of the bowl. Opposite the terminal holes in the switches bore ¼-inch holes in the aluminum, so that the bolts passing through do not touch the metal. These bolts connect the carbon holders, which are mounted on the old switch base, with the switch. Hence the necessity for good insulation.

Each of the two carbon holders is made by mounting a Fahnestock clip on a small brass strip bent at right angles. A bolt, upon which a piece of coil spring is placed for tension, holds the clip in any adjusted position. To the bolt of one clip fasten a short piece of bakelite as shown in the drawing above. This piece of bakelite projects through a slit in the aluminum projector and serves as the starter arm. Bend the Fahnestock clips so that they hold the carbon rods securely. The clips are adjusted so that the rods meet each other at right angles, but remain at a normal distance of ½ inch apart.

Commercial carbon rods obtainable from any photographic supply or electrical dealer are used. The lamp is lighted by bringing the carbons together, and then separating them a short distance until a steady flame results. The heater unit resistance will become quite hot, so it is advisable to mount it near the base of the stand.

Three kinds of carbons are obtainable for general use. Two are photographic, one giving a white flame, the other a colored flame. The third carbon gives a therapeutic light for ultra-violet health treatments.

Structural Toy Motor Made Inexpensively From Wires



Six wires soldered together form armature and field of this motor, brass strips the brush, and split brass pipe the commutator.

A SMALL electric motor that will serve ideally to run structural toy devices can be made at a cost that is practically negligible. With the exception of the brass commutator and brushes, the motor structure is made entirely of No. 10 galvanized wire, and wound with No. 22 cotton covered wire, with four dry cells providing the current.

The field is made by laying six wires side by side as shown in the drawing and soldering them together in the center. The wires are then bent into the shape shown and the tip ends soldered for firmness.

The back of the field is assembled in the same manner except that the two outside wires are 1¼ longer than the rest, serving as back legs for the motor. The two field parts are soldered back to back to form the entire field.

The armature, which is two inches in diameter, is laid out and soldered in the same manner as the field wires. The two semicircular parts are then soldered back to back to the shaft, which is also a piece of stiff wire.

The bearing supports and front legs of the motor are made of one piece of wire and soldered into the shape shown. The bearings are small rings of wire soldered to bearing supports.

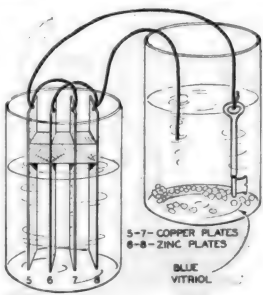
The commutator has two segments which are made by splitting a short piece of brass pipe that is half an inch in diameter, which are fitted around a fibre core and held in place by glue and a fibre washer. The brushes are made of strips of springy brass which are insulated from the frame by the insulator shown. The armature wires are soldered to the commutators and finally hooked in series with the field coil.

A Simple and Inexpensive Copper Plater for Home or Laboratory Use

COPPER plating can be an inexpensive and easily performed process if the procedure and apparatus shown at the right is used. The chief materials necessary are: two pieces of sheet copper about 2x3 inches and two pieces of zinc the same size; 3 blocks of wood ½x½x2 inches; 2 pieces of insulated copper wire about 18 inches long; and two water glasses.

After holes have been punched in the copper and zinc plates for admitting the wires, they should be glued to the wood blocks as illustrated, alternately copper and zinc. Wires should then be run through the holes, hooking the zinc plates together with one wire and the copper plates with the other. The whole arrangement should finally be placed in a jar filled with vinegar.

Into the other jar place some lumps of blue vitriol and fill with water. Copperplating is done by attaching one of the wires to the article and suspending it in the solution.



Alternate copper and zinc plates immersed in vinegar provide the copper-plating current.

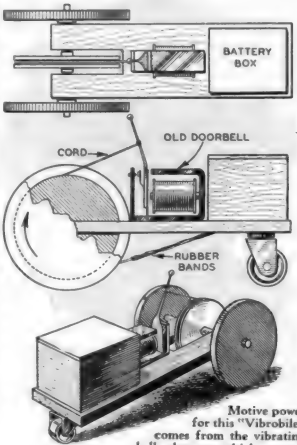
This "Vibrobile" Uses Old Door Bell for Motive Power

IF YOU have an old discarded door bell around the house you can put it to good use by making it serve as the motive power of a small "vibrobile" tractor. You will be agreeably surprised by the power that can be developed from such a unique engine, for it gives a slow but powerful rotary motion to the wheels.

All the parts are cut from ½-inch pine. The two drive wheels are 3 inches in diameter, and should be provided with rubber tires in the form of a rubber band cut from an old inner tube and stretched over the rims of the wheels.

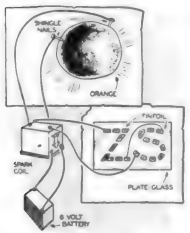
The grooved wheel in the center is 2¾ inches in diameter, and is fastened rigidly to the shaft, as are also the two drive wheels. A cord is tied to the bell clapper arm, and after passing around the grooved wheel, is spliced to a rubber band which is stretched slightly as shown in the drawing at the right. The tension of the rubbers should be adjusted to provide a snubbing effect of the cord around the grooved wheel.

A few batteries furnishing 4 to 8 volts will operate the bell. A switch may be added to turn off the power.



Motive power for this "Vibrobile" comes from the vibrating bell clapper, which creates the snubbing effect of the cord around the grooved wheel.

Spark Coil Illuminates Signs



Spark coil current makes orange glow and illuminates letters.

USING an old Ford spark coil, a clever window decorator can produce some weird stunts to attract the attention of passers-by.

Lemons and oranges can be made to glow with a luminous blue flame by jabbing two nails into the skin about half an inch apart and connecting the nails to the output terminals of a spark coil, as shown above.

An effective night window sign that lights up brilliantly can be made by gluing tinfoil strips on glass in any design desired and connecting the end strips to a spark coil.

Tag Wire Makes Cigarette Lighter

WITH a dry cell and a piece of fine wire such as comes on a shipping tag you can easily make yourself a cigarette lighter that is always at hand.

Take a five-inch piece of the wire and wind it about a match stick to make a coil of about 5 turns. Attach one end to a battery terminal, and tape the other, leaving a point sticking out. Touch this point to the other terminal till coil comes to white heat.

White heat of the wire lights cigarette.

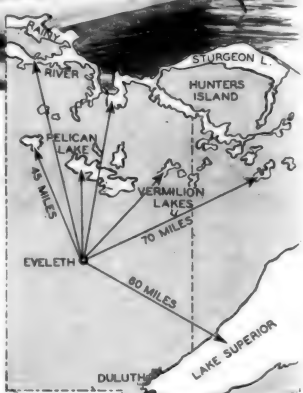
To Sportsman's Paradise

Above is shown the method of fastening canoes to the plane for carrying to the fishing grounds.

The canoe has taken to the air. The great Northwest lake region, a paradise for hunters and fishermen, has been brought to your back door by airplane.

WITH Eveleth, Minnesota, as the base of operations, the Kingston-Rhodes Airways, Inc., is using the airplane for regular transportation of fishermen and hunters to remote and previously forbidding points on the Great Lakes. Once frequented only by occasional Indian or native trappers, a Ryan airplane is now pushing back the barriers of the wilderness, as it were, penetrating 100 miles north of Duluth on dependable flights.

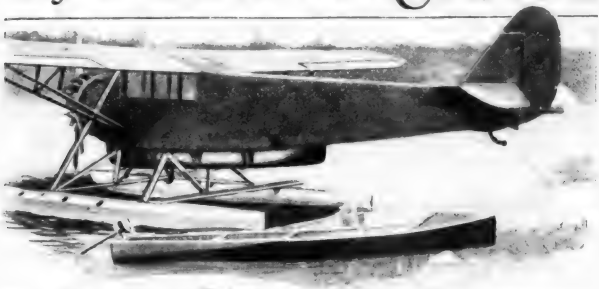
Deer, moose, and bear are among the big game found and trout and bass abound. The airplane transport company operating the so-called "Sportsman's Special" is so positive of the presence of wild game and fish that it guarantees an hour's airplane flight will reveal deer, moose, or bear and that fish can be caught. Far, far from what we of the city call civilization, this section of the Great Lakes is said to be without trails or landmarks and with dense forests and long portages between the lakes, experienced guides on foot are frequently lost in the wilderness. Exploring parties, we are told, have been lost in this little frequented region beyond the fringe of civilization and their rescue to human habitation must depend upon the chance assistance of a veteran trapper or native Indian guide.



The map shows the hunting and fishing paradise within an hour's ride from Eveleth, Minnesota.

With the introduction of the airplane, the hazards of a time-consuming trip by trail and canoe are relegated to the background. The sportsman loads canoes, camping and fishing equipment on a plane, equipped with pontoons, and within one hour the party alights on a lake—the flying machine rest-

By PLANE and CANOE



This streamlined canoe, designed especially for carrying by airplane, is used by Canadian prospectors and surveyors.

Airplane canoe offers practically no parasite resistance.

ing in a veritable fisherman's paradise. The carriage of canoes by flying craft is said to be a departure, and the single-motored Ryan airplane transports, in addition to two canoes, three passengers and their baggage. Upon alighting on the lake the canoes are unshackled and, if there is not to be a hurried departure of the plane, an 8-pound bass may be caught while fishing from the pontoons of the plane. However, the Ryan brougham soon takes leave for the airplane base at Eveleth, Minn., to return when a radio message summons it or upon a prearranged schedule.

A single day's fishing may be rewarded by 40 or 50 trout or bass and disciples of Izaak Walton frequenting this remote angler's paradise are of such increasing numbers as to prompt the Kingston-Rhodes Airways, Inc., to purchase a second airplane for fishing and hunting expeditions. The airplane is not only enabled to light on the lakes during somewhat stormy weather—when small boats have been driven to cover—but the flying machine is penetrating areas not previously visited by white man.

Planes carrying canoes are also being used to a large extent for opening up the sub-arctic regions of Canada to prospectors. These freight canoes, of a carefully streamlined type, are strapped on the under side of the fuselage of transport planes, so that when a party of prospectors has been landed in the far North it will have means of transportation over the many waterways while the plane is permitted to return to its base.

Sectional canoes had been carried for several years by prospecting and geographical parties, but they had to be taken in the cabins of the planes, thereby using valuable space. Mr. A. L. Reading of Toronto, a mechanical engineer and inventor, perfected the streamline canoe which is capable of 15 miles an hour with a three h.p. outboard.

Daredevil FIRE Fighters

Thornton, clad in asbestos, standing alongside metal wreckage hauled from a burning well.

This is the thrilling story of the methods of the men whose perilous task it is to snuff out those roaring infernos which are oil field fires—and particularly it is the story of Tex Thornton, oil field fireman extraordinary.

Tex Thornton, hero of 300 oil well fires.

ONE of the horrors of oil field fires is that they come without warning. One moment the usual well routine is in progress, the next moment all is changed: the derrick is crumbling and melting, the workmen are dead or, injured, are fleeing for their lives; while out of the earth tears a roaring monster of flames that shoots upward in rolls of smoke and white heat that reach to a dizzy height.

An onlooker at the Sanford fire—the greatest disaster ever recorded in the Panhandle field—which occurred in May, 1927, gives the following graphic account of it:

"There was considerable uneasiness about this well, an eighty million foot gasser that had just 'come in.' We feared an explosion, for every other well in that vicinity had exploded before it could be capped off—due, it was decided, to the enormous quan-

of the OIL FIELDS

by ANNIE DYER NUNN

Steam lines being run up to blow out a blazing gas well. Steam is a more expensive method of blowing out fires than nitroglycerin, but it must be used in crowded fields where the presence of other wells nearby makes the use of explosives dangerous. Note the shields to protect the workers.

tity of pebbles which were shot up from the bottom of the well and hurled against the casing by gas pressure, causing sparks that ignited the gas.

"The pressure was so great in this particular well that a double casing crew, consisting of ten men, and four drillers were employed to handle it. They worked within an enclosure that had been built about the rig to protect them from the weather.

"When I heard the explosion which sounded like the distant bark of a cannon, I dashed from my house to find the well on fire and the men darting from the burning rig enclosure, their gas-soaked clothes masses of flames at which they tore in desperation. People ran toward them in an effort to help; but the wretched men, maddened with pain, fled like maniacs and did not stop until they dropped from exhaustion. One man was on top of the rig at the time of the explosion. He was hurled forty feet and instantly killed. The others, all of whom had inhaled the flames, lived from a few hours to several days. Out of the fourteen, one worker was unharmed. He had gone to Borger, fifteen miles away, and on his way back was detained a few minutes by a train that blocked the highway over which he was driving. He reached the well shortly after it exploded."

The fires I have cited were extinguished by Tex Thornton, who is widely known as one of the most interesting daredevils in America. He has extinguished over 300 oil and gas well fires, many of them among the most terrible ever known. The bulk of his work is done in the Panhandle, but there is

Gas Pressure Can Scoop Out 200-Foot Crater Around Burning Well

To reduce the volume of flame from this burning well, it was tapped and the second outlet set afire. Pushing a tube of nitroglycerin into the heart of the flames, as sketched, Tex Thornton extinguished this disastrous Texas oil well fire.

An ordinary oil-well fire can usually be conquered by steam. This is a slower and, in the long run, a more expensive method than shooting with nitro; but there are times when steam must be used, owing to the proximity of other wells which might be set off by the explosion of nitroglycerin. However, in the case of gushers and big gassers such as are frequent in the Panhandle and Oklahoma fields, shooting is the only effectual method.

The time required to extinguish a fire depends, generally, on the location of the well and on the water supply. For instance, a well out on the open prairie is far more easily managed than one situated in a draw; for the reason that all wreckage about the well has to be got away before the shooting takes place. Otherwise, the red hot irons will cause re-ignition, and rough country is a hindrance in working with the irons. An abundant supply of water facilitates the work, as several hose must be kept running all the time in order to cool the ground near the well.

Clothed in asbestos from head to foot, Thornton goes to within a few feet of the hurricane of flames and fastens a cable to the wreckage, one piece at a time. It is then dragged off by means of a windlass attached to a truck.

After the irons are disposed of and the ground cooled with water, Thornton takes

not a field in the United States where he has not fought fires.

Thornton transports his explosive overland in high powered automobiles that are equipped with padded compartments for carrying cans of nitro, and with double shock absorbers. He drives one of these cars and his wife drives the other. The Thorntons think nothing of hauling hundreds of pounds of nitroglycerin to different parts of the country. On one occasion, Mrs. Thornton took a load of explosive from Amarillo to Corpus Christi, a distance of 800 miles.

his shots of deadly explosive, which have been poured into shells holding 30 quarts each, and slides them along an asbestos belt into the fire. Then, he runs for his life. One misstep or one instant's delay would mean death to him.

The sudden blast of the exploding nitroglycerin puffs out the flames, momentarily shutting off the flow of gas. The explosive acts, in effect, like a valve.

Thornton works in heat so terrific that the ordinary man would be instantly prostrated, but he is so accustomed to fire that his powers of resistance are far beyond nor-

mal. Even so, he sustains horrible burns and has many hairbreadth escapes. Once he slipped into the "cellar" of a well, a raging inferno of steam and boiling mud. As it happened, there was a cable hanging nearby and with this he pulled himself out of the hole. Six weeks in a hospital was the result of this accident.

Thornton rarely ever sleeps when he is on a fire job, but, unceasingly, labors day and night until his work is finished. Often he is affected by gas fumes which cause his body to swell. At such times he appears to weigh over 200 pounds, whereas his normal weight is around 160.

In this car, equipped with double shock absorbers, Tex Thornton and his wife haul nitroglycerin about the country from one oil well fire to another. Note the shells to hold the explosive.

A dramatic incident at the Corpus Christi fire, showing Thornton rescuing a photographer who crawled too close to the blazing well and collapsed.

Each fire offers a different problem and sometimes, even to a man of Tex Thornton's experience, is a staggering proposition. Take the White Point well at Corpus Christi. It had been burning three weeks when he reached it. The fire was blowing out of a crater 100 feet deep, scooped out by gas pressure. At first the mouth of the well had been on level ground, but the casing was blown off piece by piece, causing the mouth to sink deeper and deeper until, at the time Thornton shot the fire, it was 200 feet down.

Around the top of the crater which was 90 feet across, a five-foot rim had formed and was glazed over with melted sand—slick footing for Thornton, who had to drive tacks in the soles of his asbestos shoes to keep from falling into the fire. This rim had to be dynamited before it would hold enough water to cool it. Owing to the difficulty in obtaining the water, which had to be pumped up from the bay, ten days elapsed before the well was in shape to shoot.

Finally the fire was put out, but within a few hours the gas had re-ignited due to the hot ground, and the work had to be done over. Again the fire was extinguished, and again it burst out, but eventually it was quenched for good.

People came from all over the United States to see this fire; the photographers, especially, were exceedingly interested and Thornton had all he could do to keep them from getting killed. One young man donned an asbestos suit and when no one was watching went almost to the crater. Thornton, who was nearly exhausted from hours of terrible work, had just come out of the fire and changed clothes when people came running to him with the news that the photographer was lying prostrated near the well. Thornton flung on his asbestos outfit and went after him, reaching him in time to save his life.

Thornton was so angry that he threw the offender's camera into the fire.

Building the RABL RADIO

By SAM RABL

Send or receive from the same set! When you are cruising by boat or plane you can send up to 250 miles and hear 1000 with this hook-up.

DOWN in the stuffy little cabin of the Picaroon, the counterpart of the Peggy that Weston Farmer mentioned in conjunction with the natty little cruiser *Humpty Dumpty* which appeared last year in MODERN MECHANICS, the conversation ran the scale from boats to light planes and back again to the hydroglider in frame in the skipper's shop ashore. That hydroglider is being built to sprout wings some day, but that's another story.

Squeezed into the little cabin were the skipper, whose ruling passions are anything that floats, flies or goes in or out of a radio set; Bud, who occasionally gets his little Harley powered mono off the flying field when the hangar hounds don't cross his elevator controls, and Jack, who can make a three-element tube do more tricks than Houdini ever invented.

When the talk finally shifted to the hydroglider and her probable speed, Bud, as was his usual custom, brought up the question as to what we would do when the motor conked out on us and we were forty miles away. To Bud's question was Jack's usual answer, "Radio home."

"'Radio home'—that's easily said," growled Bud. "It's easy enough to do this when you are located on a nice big cruiser or a moving van but whattaya going to do when you are in the skipper's sliding egg shell or up in my little crate where ounces and not pounds count like tons on the railroad? Remember, fellow, that first of all you must have an aerial, you must pack some sort of generator to support that tube in the transmitter and you might need a *receiving set* to hear whether the ham on the other end got you or not. Where in the name of all the pink toed prophets are you going to erect an aerial on my crate or the skipper's bath tub?"

"Duck soup," retorted Jack, "use a loop."

From this point on the story is Jack's. He has handled the design of the set with the skipper's advice on things nautical and Bud's advice on things aeronautical.

As the basis of his design Jack used the radio set described under "The Flying Loop" published by Mr. Oliver Wright in the American Radio Relay League's official organ QST. He has only incorporated such changes as were deemed necessary to produce a finished product from the experimental outfit and claims no credit for the design of the circuit whatsoever. The set of Mr. Wright's was developed by him to a high state of perfection and has a *transmitting range* dependent on the type of tube and power supply, and a *receiving range* of over a thousand miles. It will receive the short wave broadcasts as well as code transmission and will transmit as well, all on the same tube.

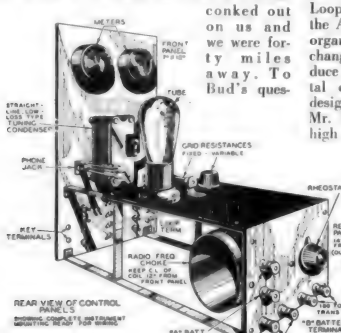


Fig. 3. Here is the rear panel view of Rabl's very clever light weight radio set for light plane or cruising boat use.

The basic circuit is a super regenerative one and is somewhat tricky to get adjusted right. But when once adjusted will work over 40 and 80 meter wave bands receiving on the same wave length that it transmits.

Fig. 1 shows the hook up so let's get the material. The condenser should be of the low loss type and a good one as must be the tube socket. I dare say that most of the parts with the exception of the meters can be found in the average radio experimenter's stock of salvaged parts or from mail order houses. The panel measures seven by twelve inches and I will not give a drilling diagram as the different parts will vary quite a bit as far as dimensions are concerned. The panel should be arranged as near as possible to the front panel view, Fig. 2.

The radio frequency choke is about the only piece of apparatus inside the set that will be made by the constructor and this consists of about one hundred turns of number twenty-eight double cotton covered wire wound on a tube three and a half inches in diameter.

From the back panel view, Fig. 3, we can see that the tube and resistance in the grid circuit are mounted on a shelf of the same material as the panel, which is in turn supported by little strap brass brackets. On the rear of these brackets is mounted another panel which supports the filament rheostat and the binding posts for the "A" and "B" supplies.

Set Is Small, Light, Neat, as Shown

Fig. 2. Arrange the front panel to look like this perspective.

Under the tube shelf should be mounted the choke. It is very important that this piece of apparatus be mounted at least

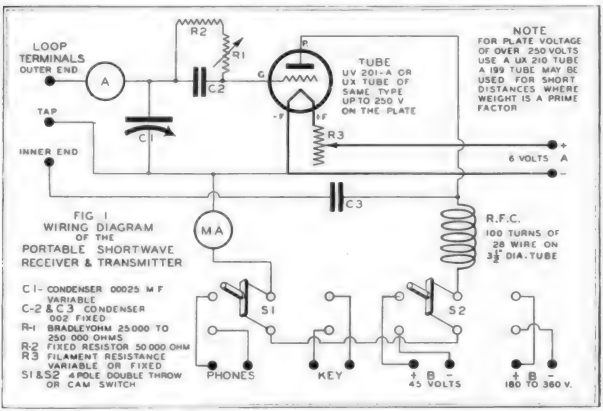


Fig. 1. The switches S1 and S2 may be incorporated in one four-pole double-throw switch that shifts the outfit from "send" to "receive" instantly. Standard tubes are used, and the set is very simple.

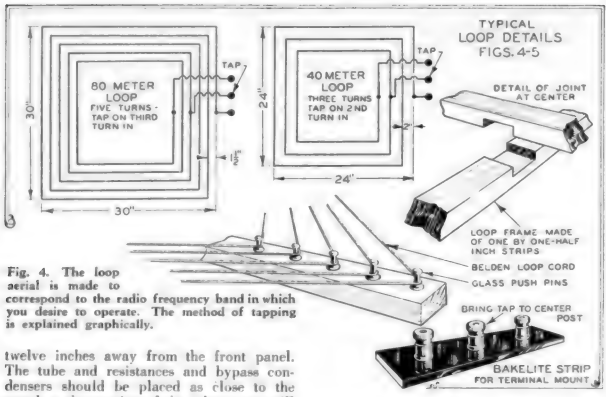


Fig. 4. The loop aerial is made to correspond to the radio frequency band in which you desire to operate. The method of tapping is explained graphically.

twelve inches away from the front panel. The tube and resistances and bypass condensers should be placed as close to the panel as the spacing of the other parts will permit them to be so as to minimize the length of the leads between the various components.

The key terminals, phone jack, and loop terminals are mounted on the front panel as is also the change over switch which should be a four-pole double-throw switch. If for any reason two double pole switches are substituted they should be arranged to work together. A vernier dial is an absolute necessity as the tuning is exceedingly sharp.

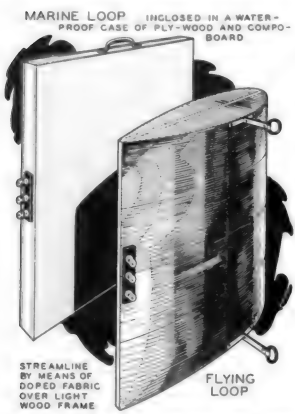


Fig. 6. This suggests two types of cases for enclosing the loop aerial used in cruisers or airplanes.

A cabinet should be made of such dimensions that it will permit the front and rear panels to be exposed and encase all the other parts. If it is intended for airplane service it should be as light as possible and in no case is it to be made of metal.

Fig. 4 shows the loop dimensions both for forty meter and eighty meter transmission and reception and they should be made on spruce frames of inch wide material one-half inch thick notched out where they cross on the center. The loop proper should be wound with "Belden" loop cord on Moore push pins as shown in the sketch Fig. 5. These pins are of glass and provide excellent insulation especially for the marine type loop which is subject to dampness.

For protection the marine loops are encased in a light box (Fig. 6) made from compo board or plywood and the aero loop is encased in a streamline casing made of light framework covered with fabric and doped as are the wing surfaces of the planes. In airplane work it is very neces-

(Continued on page 206)

Building Provides Mooring Masts for Zeps

This composite photograph shows how the Graf Zeppelin compares with Empire State building.

NEW YORKERS may soon become accustomed to the sight of giant lighter-than-air liners moored to the tops of downtown skyscrapers, for the Empire State Building, now under construction at 34th Street and Fifth Avenue, when completed will be topped by a mooring mast of the latest type.

This new building, which will rise to a height of 1100 feet will top the Eiffel Tower of Paris by 174 feet and will be the tallest structure in the world. It is planned to make this building the western terminal of trans-Atlantic airships.

Fast Burning Tear Gas Candle

THE successful use of tear gas in quelling prison riots has resulted in great interest by prison authorities in this chemical agent which does its work without causing injury. The Chemical Warfare Service of the army, as a result of requests for a tear gas device that will produce a gas cloud immediately of high concentration, recently has shipped to Governors Island, New York, two dozen of the new universal fast burning tear gas candles for test there.

These candles were developed in order to meet the demand for a tear gas weapon that will produce an effective gas concentration so quickly that a rioter will be made helpless immediately. The fast burning candles are used in the same manner as a grenade but differ from the latter in that they have a larger capacity, and the tear gas is generated with almost explosive violence. Thus the gas gets into the air with no delay and in great volume.

The older grenades were somewhat slow in ignition and the gas was generated slowly. The fast burning candle ignites so rapidly after leaving the hand that by the time it hits the ground it is giving off its fumes in great quantities. The test of these candles will be watched with great interest not only by the army but by civil authorities, who agree that tear gas is a most effective and humane method of quelling disturbances.

Oval Auto Cylinders Cut Length

AN automobile engine has been built in England with elliptical cylinders, the idea being to save length, the narrow way of the cylinders being placed in a fore and aft position. Thus a 3x4¾ cylinder would be equivalent to a 3¾ round cylinder but take no more length than one 3 inches in diameter.

SPARKS from the RADIO EDITOR

Edited by L. B. ROBBINS

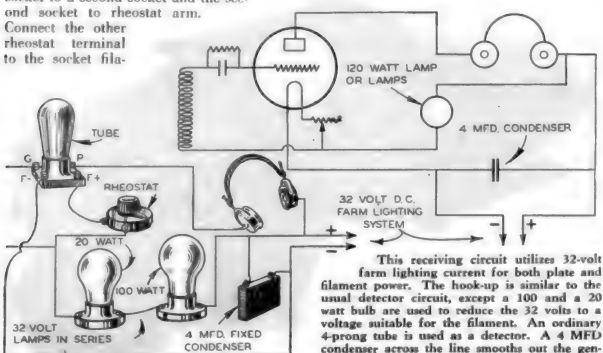
This is the month when radio listeners must put up with that constant crackling noise known as static. The "time out," however, can be wisely used to overhaul your apparatus and put it in shape for the fall and winter. This month Mr. Robbins offers some good suggestions for greatly increasing the efficiency of your radio set.

Farm Lighting Plant Provides Power for Tube Receiver

RADIO fans who are blessed by the possession of a 32-volt farm lighting plant need not worry about "A" or "B" batteries for a vacuum tube receiver, for by hooking up their apparatus with the circuit below the batteries can be eliminated altogether. Except for the slight generator ripple the signals are equally as loud and clear.

The usual hook-up of the detector is used as shown. Disconnect one side of the headphones and connect it direct to the plus side of the line. From this same point run also a wire to a porcelain socket. Connect this socket to a second socket and the second socket to rheostat arm. Connect the other rheostat terminal to the socket filament terminal, and the filament return terminal to the minus side of the lighting line. Continue from the rheostat terminal to the bottom of the secondary of the tuner as shown, and then shunt a 4 MFD fixed condenser across the 32-volt line. Insert a 100 and a 20-watt bulb in the sockets and you are ready to tune in.

The 32 volts provide plate power, and the bulbs reduce it for filament use. The same power source can be used in an additional stage of amplification.



This receiving circuit utilizes 32-volt farm lighting current for both plate and filament power. The hook-up is similar to the usual detector circuit, except a 100 and a 20 watt bulb are used to reduce the 32 volts to a voltage suitable for the filament. An ordinary 4-prong tube is used as a detector. A 4 MFD condenser across the line smooths out the generator ripples, insuring clear reception.

New Short Wave Set Brings in Music From Whole World

THE latest short wave receiver on the market to delight the heart of radio fans specializing in long distance reception is the new Pilot A. C. Super Wasp, shown in the photo at the right. It operates entirely upon alternating current, and has screen grid amplification with double shielding. The A. C. hum is practically negligible.

The entire set comes in kit form and can be easily assembled. Five pairs of plug-in coils are provided, permitting reception on waves from 14 meters up to 500 meters. All body capacity is eliminated by metal shielding on the front panel and around the detector and R. F. amplifier.

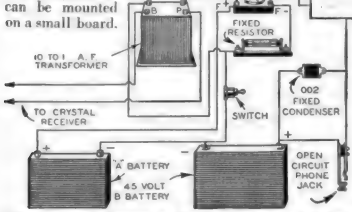
With earphones, practically all short wave stations in the world can be heard.

This new Pilot A. C. Super Wasp receiver comes in kit form and can be easily assembled by any radio fan.

This Simple Amplifier Increases Clarity and Volume of a Crystal Set

BELIEVE it or not, there are thousands of crystal receivers still in use. Radio fans who are using such sets can make an amplifier which will increase the volume and clarity of the signals very cheaply out of old discarded parts. Today almost any friend who is a "ham" or "fan" will donate an old audio transformer, a filament resistor, an old socket, a jack, and a fixed condenser for your use. Then a cheap bootleg tube and "A" and "B" batteries will complete the job.

The apparatus can be mounted on a small board.



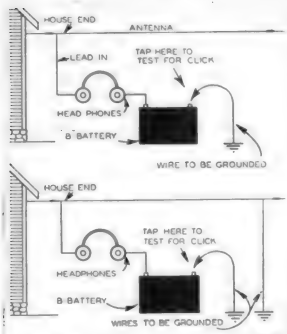
This simple and inexpensive amplifier hook-up can be put together from old parts and mounted on a small board. The switch cuts off the power to the set when not in use.

thus eliminating the costly panel. Fahnestock clips from old "B" batteries can be used as input and "B" and "A" battery terminals. The circuit used is diagrammed below. The plate and B plus terminals of the transformer go to the crystal detector, and a single circuit jack takes care of the phones.

Use a 10 to 1 transformer if possible; the higher the ratio the better. A UV199 tube will be the most economical to use as it requires only two dry cells. A 45-volt block will prove sufficient for plate power, and even a 22½-volt block will suffice.

When the crystal detector picks up a signal, it will come in much louder and clearer when amplified.

Here's How to Shoot Trouble in Antenna with Phones



Above diagram shows method of testing for grounded antenna with battery and phones. Below: method of testing for open circuit in antenna.

Midget Condensers Get Distance

WHY don't we tune in stations a thousand or more miles away as in the old days? The explanation is simple.

Present day radio receivers, sensitive as they are, are not primarily intended for long distance reception, as in the old days. Increased power of broadcasting stations and congestion of the broadcast air has caused sets to be built for increased selectivity rather than sensitivity. The simplicity of present day receivers calls for gang tuning condensers and thus militates against extreme sensitivity.

Gang condensers are matched as closely as possible at all frequencies. However, it is physically impossible to have several condensers ganged and remain in positive electrical step. With the older style individual condensers positive tuning of each stage was possible and greatly improved the sensitivity.

Nowadays radiotricians are catering to local demands for such increased sensitivity by providing each condenser in the gang with small capacity midget variable condensers shunted across in parallel. Thus a positive maximum tuning is given each condenser after the station is tuned in, with the result that greater volume can be obtained than with the gang tuning alone.

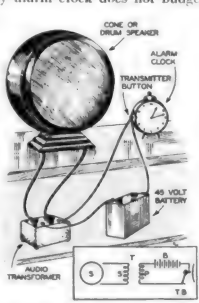
AFTER an antenna has been up for some time corrosion and weathering may have caused an "open" in some soldered joint or frayed most of the strands apart. This will evidence itself in weakened signals. Moisture and close proximity to grounded objects may also cause the antenna to become grounded. This will also cause loss of volume and extremely broad tuning. To test out for either of these conditions is a simple matter and only requires a pair of headphones and a "B" battery.

To test for a grounded antenna, hook up the phones and battery as shown in the upper diagram at the left. Then touch the grounded wire to the battery terminal. If there is a click in the phones you can be sure that your antenna is grounded at some point.

To test for an open circuited antenna it will be necessary to connect a grounded wire to the outer end of the aerial, as shown in the lower diagram at the left. To test, tap grounded "B" battery wire on the battery terminal. If there is no click in the phones, it is certain that there is an open circuit somewhere. After these tests have been made, overhaul the antenna at every point likely to be the cause of the trouble.

Speaker Intensifies Alarm Bell

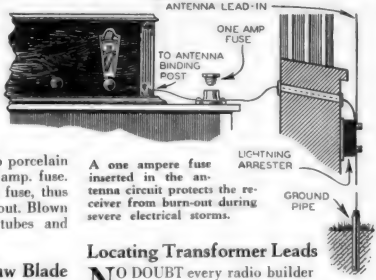
IF YOU are a hard sleeper and find that an ordinary alarm clock does not budge you in the morning, try the stunt in the diagram at the right. Attach a transmitter button to an alarm clock and hook it up with a battery, amplifying transformer, and loudspeaker as shown. If this doesn't raise you, then nothing will. A switch may be added.



The alarm bell sound is picked up by the microphone button and intensified in speaker with circuit.

Fuse with Arrester Avoids All Danger of Set Burn-out

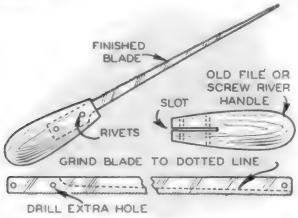
DURING an electrical storm an ordinary lightning arrester is not always sufficient protection for a radio set, for sometimes, even though a charge of lightning grounds, some of it surges through the set. Accidents of this kind may be avoided by cutting the antenna lead and hooking in a cheap porcelain socket as shown. Then insert a 1 amp. fuse. A dangerous surge will blow the fuse, thus saving the set from being burned out. Blown fuses are cheaper than blown tubes and condensers.



A one ampere fuse inserted in the antenna circuit protects the receiver from burn-out during severe electrical storms.

Panel Cutter From Hack-saw Blade

A RADIO fan who does not own a panel cutter can make one very easily out of a sharp hack-saw blade and an old screw driver handle. Grind down the smooth edge of the blade, dipping it in water frequently to keep it cool. Drill a second hole in the blade and rivet it into a slotted screw driver handle.



The hack-saw blade panel-cutter is ground down as shown above and riveted into the handle.

New Antenna Eliminates Blanket

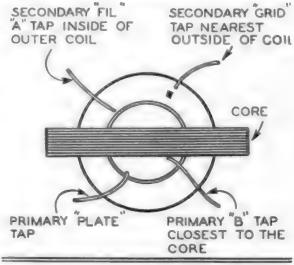
IN THE past it has been necessary for radio engineers, when erecting high powered broadcasting stations, to compromise between powerful signals which reach outlying districts, and overwhelming local signals that prevent local radio fans from tuning in other programs. With the new antenna designed by Dr. Frank Conrad, however, it will be possible for a high powered station to transmit strong sky waves and weak ground waves, thus doing away with the local blanketing.

Locating Transformer Leads

NO DOUBT every radio builder has several old audio transformers lying around, some of which have the winding terminals unmarked. It then becomes a puzzle to know just what leads to use in properly hooking the transformer into a new circuit. The diagram below shows just how this can be easily accomplished.

There are four leads; two from the primary and two from the secondary. The lead nearest the outside surface of the coil should be labeled "grid" and is in the secondary. The next lead from the outside coil is the inside of the secondary and is the "A" or "fil" tap.

The lead closest to the iron core is the primary "B plus" and the remaining lead is the primary "plate" tap.



Amplifying transformer leads may be located and marked as shown in the diagram. The inner coil is the primary and outer coil the secondary.

Sightseeing Restaurant for Chicago World's Fair in 1933

Building revolves on its axis every half hour.

MANY unusual buildings are now being planned for the Chicago World's Fair to be held in 1933. The most modernistic of these odd structures will be this huge sightseeing restaurant atop a gigantic column which is being designed by Norman bel Geddes.

The huge concrete base will house the machinery for turning the column and will contain foyers, reception rooms, and parking space for several hundred cars. Three elevators contained in the column will carry passengers to and from the gigantic spiral promenade. On the innerside of the spiral a glass enclosed restaurant will permit visitors to obtain a bird's-eye view of the exposition while they dine.

Rifle Fires Sixty Shots a Minute

A RIFLE only slightly larger and no heavier than the present service rifle, which secret tests by the British army have revealed will fire 60 shots per minute, has been perfected by Colonel Pedersen, an American. The bullets are streamlined and have a muzzle velocity of 2,600 feet a second. The present service rifle fires only ten rounds a minute.

Beauty Machine Pats the Face

A NEW beauty machine that gently pats cosmetics into the skin as advised by beauty and skin specialists has been brought out by a Connecticut manufacturer. The device is equipped with a cord for connection to light socket.

Gas Heater Warms Entire Room

AN ENTIRELY new and different type of radiant gas heater for residential use recently has been patented and placed on the market. Whereas the ordinary heater has a straight face which throws the heat directly to the front, this new heater is curvilinear in design, thus permitting radiation in three directions instead of one. Thermometer tests show practically the same distribution of heat to the sides as to the front.

Perfected combustion chamber prevents fumes.

A unique arrangement of the burner and mixing chamber permits an even flow of gas to each of the radiants, this insuring perfect combustion with no danger of monoxide fumes. The heater can be regulated to burn either artificial or natural gas by making a simple change in the mixing chamber. The heater has passed all tests of the American Gas Association.

Clumsy Specs Eliminated by Small Invisible Eye Glass

The concave curvature of the lens permits it to rest without irritation over the eyeball.

The eyeglass, worn as shown above, fits snugly under the eyelid and is easily inserted or removed by the user.

Invisibility is the glasses' chief feature. They cannot be seen on the man in the photo above.

AWKWARD and all-too-conspicuous spectacles may in time go the way of ear trumpets and bustles when the diminutive and invisible eyeglasses shown in the photos above, an invention of Prof. Dr. L. Heine of Kiel, Germany, come into widespread use. The glass is a thin curved lens that is worn monocle fashion beneath the eyelid in the horny coat of the eye. It can be inserted or extracted by the patient.

Antique Timepieces at Jewelers' Exhibit Show Ingenuity of Ancients

HUMANITY, involved in the busy routine of living since the dawn of time, has always had to know the time of day, so that they may apportion out the time they have to give to their varied interests. A few of the time measuring contrivances that men have devised in past ages are shown in the photo at the left. These are a part of the $500,000 collection exhibited at a recent Chicago Jewelers' Association meeting.

A few types of timepieces devised by inventive ancients and primitives are shown. The man is holding a modern clock.

The sun dial, the device at the left, was probably the first alarm clock. When the sun came to a certain hour position the rays, focused on the fuse-port by the burning glass, ignited the powder. The other timepieces are, right to left, the water clock of ancient Greece, the candle clock of Alfred the Great, Father Time's hour-glass, and the Calendar stone of ancient Aztecs.

A modern timepiece is being held by the man. The chief differences in the ancient and modern timepieces lie in the mechanism. Where the ancients put nature to use to indicate the time, modern man uses machinery.

Experiments with

by C. FRANCIS JENKINS
Inventor of the movie camera.

Last month Mr. Jenkins explained some of the phenomena of air current behavior, with simple experiments to prove the scientific reasons for their acting as they do. This month he presents some seeming paradoxes involving air streams and shows how to construct simple pieces of apparatus which will give you a good understanding of such phenomena as tornadoes, gliding airplanes, and planing speedboats.

Instead of being dislodged when the experimenter blows through the tube, the vane-propeller whirls merrily—you can't blow it loose! The reason why is explained below by Mr. Jenkins.

TWO airplane hangars stood side by side on a flying field during the war. One day, when both were open, black clouds announced the approach of a violent wind storm, and hurried efforts were made to close both hangars and secure the planes. One was closed in time, but the other remained open.

The closed hangar collapsed and the heavy roof fell in and wrecked all the planes. The open hangar and its contents were undamaged.

In the closed hangar there was a pressure, since it was near sea level, of more than 14 pounds of air to the square inch, while outside the high velocity air, accompanied by a decreased pressure, pulled the sides of the building into the swiftly moving stream. The hangar with open doors was able to adjust itself quickly to the change in pressure, and so escaped damage.

The phenomenon of "exploding" buildings, blown outward by their interior pressure, is familiar in every tornado, and many of you probably have seen the sidewalk littered with plate glass after a big show window has burst outward in a windstorm. Obviously, if you want to save your windows the remedy is to leave the door open. Another unusual thing about tornadoes is that the back wall of the building—that is, the one on the opposite side from which the storm approaches—is the first to fall. Why? As we have seen, the surrounding air is drawn into the fast moving stream, and, with an excess pressure on the side nearest the storm, normal pressure within the building, and a partial vacuum behind it, the rear wall naturally is sucked outward first.

The power of a fast moving stream of air to displace objects is, of course, supplemented by the normal air pressure around them. You can illustrate this with a cork, a paper cone, and a small piece of wire. Drill a hole through the center of the cork to fit it on the end of a small tube—either rubber, paper or metal. Paste the paper into a cone about two inches long, forming it around the cork so its sides will have the same angle as the taper of the cork. Next bend the wire into a loop and handle to hold the cone.

Now slip the cone into the wire loop and hold it three or four inches in front of the cork. Blow through the tube, so the wind

Air Currents

Another mystery! The hollow cone on the subject's hand is made of paper. When he blows through the cork, the air stream passes through the center of the cone and, instead of forcing it away, causes it to leap forward onto the cork!

stream passes on through the hole in the center of the cone. The paper cone will leap out of the supporting loop and jump forward onto the cork. The air stream has passed through the cone, and in passing has drawn in the surrounding air, which, in turn, has exerted pressure on the tapering cone and moved it forward, in the opposite direction to that of the moving air.

An interesting propeller, mounted on a spool, can be made from a thin sheet of tin or copper. Cut out a disc two inches in diameter and inscribe a ¾-inch circle around the center, and another circle ⅛ inch in from the edge. Divide the circumference in eight parts and lay out eight vanes, ⅛ by ⅜ inch, as shown in the photo on page 134. With a sharp cold chisel cut around three sides of the vanes and bend them upward. Solder a pin in the center to serve as an axle. Solder a ¾-inch disc, with a small hole in the center, to the end of a small metal tube. Now insert the pin in the end of the tube and blow. The air escaping over the nearest surface of the propeller disc will keep it from slipping off, and the escaping air, striking against the vanes, will revolve your propeller—clockwise, if you cut them as shown, or counter-clockwise, if cut at the opposite angle.

Here's another clever demonstration. To the end of a small copper tube solder a copper funnel shaped cone, with its sides forming an angle of 90 degrees, as shown in Fig. 15. The end of the cone should have a diameter of about one inch. Next cut out a circular piece of copper ¾ inch in diameter, and support it in the end of the cone, as shown, with three short wires, soldered to the funnel and the deflector plate. When you blow through the tube the air stream will then be deflected outward, as you can see. Now hold the ping pong ball in the palm of your hand three or four inches below the funnel and blow through the tube. The ball jumps out of your hand and upward to the funnel, where it clings as long as you keep blowing.

What has happened? Why, the cone-shaped stream of air, deflected outward in all directions, has drawn into it the still air above your palm, and likewise the ball, which, as our first law stated, is an object free to move in a fluid, and therefore will move toward that part of the fluid having the swiftest motion.

With a ping pong ball, a water tumbler and a piece of rubber tubing you can create an interesting parlor game. Place the tumbler on the table, with the ball a couple of feet away, hold the end of the tube below the top of the ball, directed toward the glass, shown in the drawing, and blow. The surrounding air and the ball, being free to move, will be drawn into the glass. With a little practice you can put the ball in the

A tube with a cone-shaped end, fitted with a deflector plate in the funnel as shown at right so that air forced through the tube passes around the edges of the funnel, causes areas of pressure which support a ping pong ball against the deflector plate instead of forcing it downward.

glass every time, and from distances as great as three feet or more, depending on your lung capacity.

The same law that applies to movement of bodies in air will apply in liquids. That is why rapids, such as the gorge below Niagara Falls, have a high crest in the center, as the still water along the sides is drawn into the swiftly moving stream, and why a log thrown in at the edge is drawn to the center to ride the crest, instead of being pushed aside by the moving water. Every summer swimmers are drowned in the undertow at the beach. That's because they are drawn into the swiftly moving outrunning water next to the smooth, sandy bottom, and held there despite their best efforts to get free.

A speed boat sinks by the stern for the same reason, the water under the boat being thrust aft faster than the surface water. A bolt of wood going over a waterfall does not come to the surface until it is some distance away, though the same bolt dropped into quiet water will bob up immediately.

The law applies equally to two dissimilar fluids, such as water and air, and that explains the waves in the ocean during a storm. The passing wind stream lifts the water into a hump, and this water hump slows up the wind movement, robbing the air of its lifting power, until the wave collapses, releasing the wind to go ahead and repeat the performance.

Liquids, you know, may also capture air, as happens when you draw a glass of water at the faucet, and find, after you have turned off the stream and the air bubbles have escaped that you haven't a full glass.

A very simple air pump is built on the same principle, a pump that has no moving parts. Vertical pipes are set under a water fall, the water capturing the air as it tumbles down the pipe. At the bottom the air is released in a pressure chamber, while the water flows quietly away. The pressure of air is proportional to the height of the waterfall, and the area of the water exit from the chamber. The great mining camp of Cobalt, in Ontario, is run on compressed air, supplied throughout the district through pipe lines and sold just as gas or water or electricity is sold in cities.

The grain elevator man employs this same principle to move tons of wheat. He pours it on a flat moving belt and the wheat humps up in a ridge in the middle of the belt as soon as it attains the belt speed.

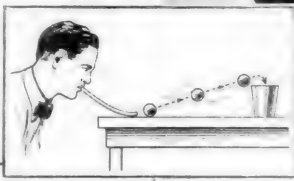
In 1894 I patented a super-slow motion picture camera, through which I ran film at the rate of 200 feet a second so that when it was shown at the usual rate of 16 small frames a second the motion was slowed down so much that we could show cannon projectiles in flight, and similar things. The mechanical problem of moving film at that rate, and the optical problem of sufficient exposure was easily solved, but I worked for 25 years before I learned how to hold the film in the exact focus of the lens. And when I did succeed it was simply because I let fast moving air do the work. I found film moving that fast attracted air to its surface, so I used a film channel that was

just wide enough to let the film ride through between two cushions of air, which kept it in exact focus without any friction that would have set it on fire.

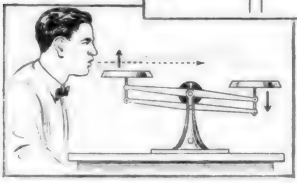
Just one more example of the lifting effect of moving air, and then I'll close this series by telling you why a flag flaps. If you have access to a pair of druggist's scales, or balance, turn one of the pans upside down, place it on its support, and blow across the smooth top surface. The pan on which you blow will rise, and its mate will sink. Your breath has actually made the pan weigh less, it seems. What has happened is that you have decreased the column of air which the pan was weighing before you blew across it.

And now for the flag. When the air starts moving down the bunting the flag moves to the side on which the stream is fastest, creating a hump. The hump, in turn, slows up the air until the stream on the other side is fastest, and then the bunting humps in that direction. The process is repeated, first on one side and then on the other. The flag flutters just as fast or slow as the breeze is strong or weak.

Try making the models suggested in this series, and when you are through with them you are ready to take up the study of flying model airplanes or gliders. If you have a vacuum cleaner and a mailing tube, you can make paper model airplanes, weight their noses with paper clips to give them the correct gliding angle, and fly the models in the air stream forced through the mailing tube. To do that you will need to mount a small straightener over the end of the tube, to straighten the air stream and keep out whirls. All you need is a number of metal sheets, a couple of inches wide, mounted in a wooden framework with spaces of a quarter of an inch or so between them.



Above—a ping pong ball, placed in the air stream forced through a tube, remains supported in the stream and follows the tube about when it is moved, as long as the air continues to flow.
At left—A ping pong ball can be blown into a water glass from a distance of two or three feet.



Decreasing the column of air above the scale pan by blowing upon it causes it to rise as shown.

This will help you to understand the action of airplanes and gliders. The modern airplane, by the way, is still far from being a good glider. A fairly good gliding bird, like a turkey buzzard or a hawk, has a gliding angle of 1 in 250, while the albatross has an angle of 1 in 500. In other words, a 500 mile glide, from a height of one mile, would be easy for the albatross, while the best a modern airplane can do is 20 miles from the same height.

HOME WORKBENCH

Edited by A. NEELY HALL

Mr. Hall, editor of this monthly department of Modern Mechanics, is nationally known as author of such well-known books for young craftsmen as "Carpentry and Mechanics for Boys," "Outdoor Boy Craftsman," etc. His projects this month are timely for summer building.

Easily Built Minnow Box Keeps Bait in Good Condition

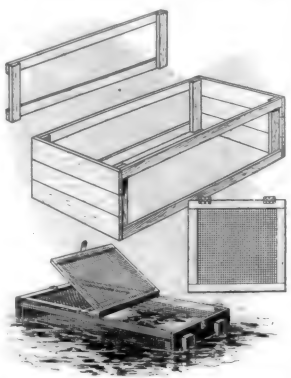
A BAIT-BOX is well worth one's time to build, because it will last indefinitely if taken care of, removed from the water late in the fall, dried and put away under cover. It is wise to select a shady spot to anchor the box, also to shield it on the windward side from waves that might dash minnows against the sides and injure them. A handy place for the box is beneath a pier. The pier floor boards can be battened together and hinged, directly above the box, to gain access to it. There must be ample air supply. Don't overcrowd your bait aquarium. These are important safeguards for keeping bait in good condition.

To build the box, first prepare two frames of 1-by-2 strips. Fourteen inches wide and 30 inches long are good dimensions for the frames. When you have knocked together the pair, cut enough boards 16 inches long to form the box ends, and nail them to the frame ends.

The next step is to cover the sides and bottom of the box with galvanized screen cloth. Fasten the screen cloth with small netting staples, and pull it taut as you work, to make a neat job.

The drawing shows a screen door for the top. Two small doors like this are better than one large door. However, if the box is installed beneath a pier, the screen doors may be dispensed with, because the hinged section of pier floor will be sufficient cover. Fasten a hinge-strip about 3 inches wide, across the box top at the center, then build the screen doors to cover the openings each side of the strip. Hinge each door to the hinge strip, and attach hinge hasps to the outer edges, and staples to the box ends, to provide for padlocks.

To anchor the bait-box, drive four stakes into the lake bottom, at the right distances apart, and deep enough to make firm anchorage. Fasten the box between the stakes, with the top several inches above the water level.



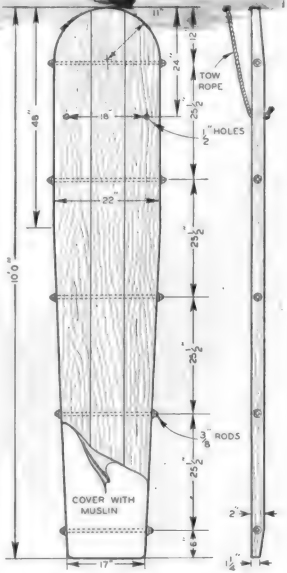
Parts of the minnow box are shown in diagram.

Balsa Wood for Water Scooter Makes Buoyant Craft

MAKE this motor-boat trailer of balsa wood if you want a very light buoyant craft. Other woods suited to the job are redwood, cedar and pine. When you order planks for your scooter, make certain that the stock is straight and true. Lay out the outer planks with the outer edge to taper from a point 48 inches from the bow, to the stern, and saw them off along this line. Then locate centers for bolt holes, following the given dimensions, and bore the holes through the planks. Locate holes with the same spacing upon the edges of the center plank, and bore them with equal care.

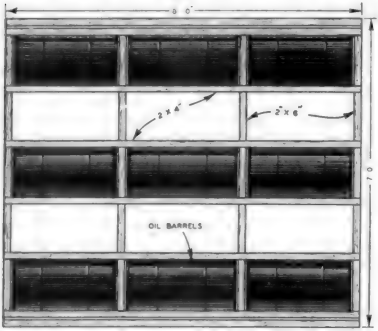
Get a blacksmith to help you in shaping the bolts from five ⅜-inch rods, with enough added length to allow for threads for nuts, and have him thread the rods, with the threads cut far enough back to permit pulling the planks together to make tight joints. When ready for the assembly, coat the edges of the planks with waterproof glue, screw a nut onto one end of each rod, add a washer, slip the rod through its hole in the plank, add a second washer, and then the second nut. Screw up the nuts until tight. Then saw off the rod ends flush with the nuts.

When the glue has set, describe a circle on the bow to locate the finished outline. Trim off the scooter on this line. Also, round off the corners of the stern. Bevel off the under side of the bow and stern. Cover its surfaces with a heavy grade of unbleached muslin, fastening this with marine glue.



Plan and dimensions of buoyant water scooter.

This Raft Diving Platform Floats on an Oil Barrel Base



How the nine oil barrels are arranged for the platform base. Size may be altered according to number of barrels at hand.

HERE'S that floating platform which you fellows have been planning to build these many moons, but which you just haven't got around to. Get a jump on the season this year, and have all of the material in hand by the time your vacation begins. Getting the thing organized is half the job. Indeed, the gang can knock together the raft and tower in half a day, once a good start has been made.

The raft shown in the drawing is supported upon nine oil barrels. A little scouting will usually bring its reward, but if the net total obtained falls shy of the number specified, go ahead with the job, install the barrels that you have, and add the remainder later. A garage, junk shop or dump will usually be able to supply you with barrels. Dents in the sides or general rusted condition is no handicap for the purpose you are going to put the barrels to.

The plans show a raft with a platform 7 feet by 8 feet. If your ideas or requirements dictate other dimensions, follow them. The sketches show a low tower. Maybe you will want a double-decker. That's up to the bunch. There may be a tower on the beach, saved from the wreckage of last summer's pier, which you can rebuild, or possibly set up as it is; if so, you are so much to the good.

Begin the raft by knocking together a frame of 2-by-6s, or 2-by-8s, of the dimensions of the platform. This will form a crib for the barrels. Between two opposite sides, fit in additional pieces of 2-by-6, to come between the barrel heads. This frame will form the sill plates on which to lay the 2-by-4 platform joists. Cut the joists of the length of the frame, and spike them in place, placing two along each side, and spacing the intermediate members so that the rows of barrels will fit between. With the framing completed, lay the platform floor of planking or boards, and trim off the ends flush with the joists.

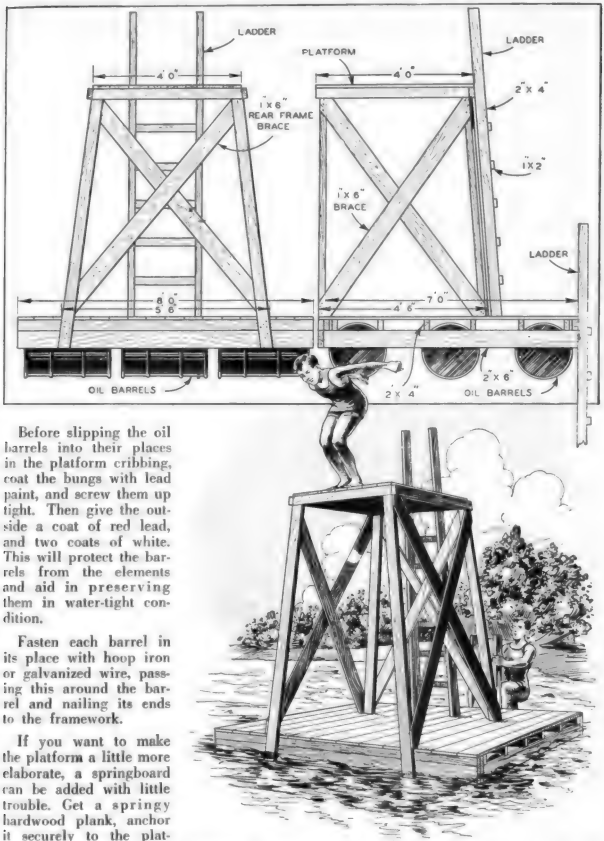
There is no need to dwell at length upon the construction of the tower. The drawings suggest dimensions for a small platform. Two-by-fours are stout enough for uprights, if properly braced. One-by-six boards placed diagonally as shown, will make a rigid structure if all members are well spiked. If you are going to make a double-deck tower, be sure that it is well braced in all its parts.

The easiest way to build the tower framework is to knock together two side frames, set them up and join with braces. I suggest side frames because they will be alike, only opposites. Build one frame, using one long upright to spike to the front of the raft platform, and one shorter upright to spike to the platform floor. Spread the foot of the short upright, as shown. Connect the tops of the uprights with a 2-by-4 plate, and brace the pair with two diagonals. With this frame made, place it flat upon the ground, and build the second one upon it so as to get it of the same size and shape.

When you have set up the frames with the correct inclination and spacing, connect them at the top with 2-by-4 plates, and brace with diagonals. Diagonals may be dispensed with at the front, as the uprights are securely spiked to the face of the platform.

Build the two platform ladders as shown, with 2-by-4 rails and 1-by-2 rungs. Plane off the edges of the rung strips, to remove their sharpness.

Diving Tower Can Be Made Double-Decker, with Springboards if Desired



Before slipping the oil barrels into their places in the platform cribbing, coat the bungs with lead paint, and screw them up tight. Then give the outside a coat of red lead, and two coats of white. This will protect the barrels from the elements and aid in preserving them in water-tight condition.

Fasten each barrel in its place with hoop iron or galvanized wire, passing this around the barrel and nailing its ends to the framework.

If you want to make the platform a little more elaborate, a springboard can be added with little trouble. Get a springy hardwood plank, anchor it securely to the platform tower, and wrap the other end with several thicknesses of burlap to provide a firm foothold.

If you prefer a double-deck tower to the one illustrated here, you can easily change the plans.

Sound Film Now Repeats Dialed Telephone Numbers

Dialing selects correct film for repetition.

THE principal convenience of the dial telephone was that it enabled you to pick your own wrong numbers, but even this is done away with now by a sound film which repeats the number which you have just dialed and enables you to correct the mistakes which you may have made.

The new invention does not necessitate the use of the subscriber's voice. The subscriber merely dials the number and that number is called to central as the sound film automatically repeats the number through a loud speaker. The new method is expected to be put in use before the end of the year.

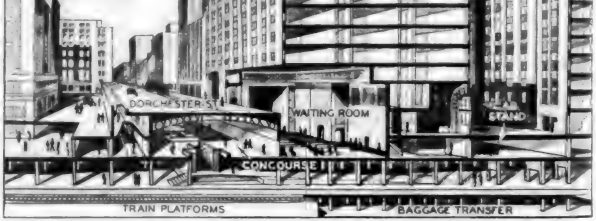
Miss Catherine Marie Shaugnesy, who was picked to record the various sounds when tests showed her to possess the clearest voice, is shown here listening to the numbers being repeated from the loud speaker while Sergius P. Grace of the Bell Telephone Laboratories dials the numbers.

Welding Goggles for Small Jobs

WELDING goggles for small jobs are improved by grinding off the upper third of the lenses. In use, the operator looks over the top until ready to weld, then through the lower part as usual.

Canadian National Railways Plan Ultra-Modern Montreal Terminal

THE traffic congestion usually found in the vicinity of a large railway station will be reduced to the minimum at the new Montreal terminal planned by the Canadian National Railways by double-decking the approaching traffic arteries, placing cab stands under the street, and making it unnecessary for pedestrians to cross streets carrying vehicular traffic by providing an underground concourse. Air rights above the tracks have been leased for office buildings.



Sectional view shows relation of concourse, streets and railway platforms of new Montreal terminal.

Tray That Hinges Into Carrier Lightens Maid's Work

A COLLAPSIBLE service tray recently placed on the market by an English manufacturer, has many new and advantageous features. The tray shown in the photo at the right is laid flat on the table for filling and when picked up unhinges into an automatic locking double decked food carrier that can be held in one hand. This leaves the other hand free for opening doors, etc. When laid on the table the carrier flattens out into a tray again. The device is very rigid and finished with a lacquer that is not affected by hot or cold plates.

This service tray is convertible into a carrier by lifting handle and flattens out when put down.

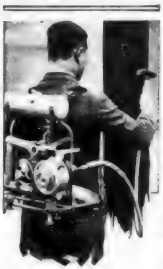
Future Men of War from Aluminum

WITH tonnage as the measuring stick of a nation's naval defenses since the disarmament conference, one of the chief features to be sought in future men-of-war is small weight combined with powerful and effectual guns. The solution is to be found in the use of aluminum alloy is the prediction of an eminent London metallurgist. Warships made of such light metal will make possible the partial evasion of tonnage limitation it is claimed.

In soundness of mechanical properties and reliability aluminum alloy compares favorably with cast iron, brass and bronze. The metal can be used in the construction of the hull and the superstructure and interior and will bring about a great saving in tonnage, leaving more weight for cannon.

Trees Painted Rapidly by Sprayer

PAINTING trees to protect them against the ravages of caterpillars is a laborious process when only a paint brush is available for the purpose. In the photo at the left is shown a portable spraying device recently invented that coats the trees with the insecticide with considerable less labor. The liquid is carried in the tank at the top and the blower is run by an electric motor.

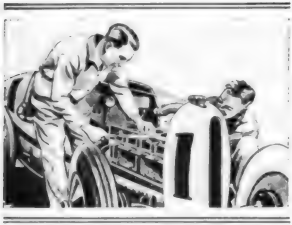


Dual Controls on Car Aid Students

A DUAL control car in which a motorist student may learn to drive far from the maddening crowd is a feature of the service extended to its customers by a prominent San Francisco automobile company. The car shown below is equipped with two steering wheels, one for the student and one for the teacher, and two clutch and two brake pedals. The teaching ground is the large roof of the company's building.

The students' automobile with dual controls.

MOTOR MECHANICS



Edited by RAY F. KUNS

Mr. Kuns, editor of this monthly department, is principal of the Cincinnati Auto Trades School and editor of Auto Digest, national trade journal. He is an expert in all phases of car maintenance and operation, and his advice has made motoring more pleasant for thousands of car owners.

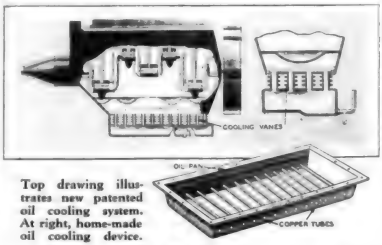
Lubrication Troubles Are Eliminated by Cooling the Oil

DRIVERS who experience trouble with lubrication, such as is the case in extremely warm sections of the country, may eliminate the troubles, if these are due to overheated oil, by one of several cooling methods.

The drawing shows oil-cooling tubes set into the oil pan. These tubes should be approximately ¾ inches in diameter and soldered or brazed in the pan to make them leak proof. Air circulating through the tubes assists in cooling the oil. If there is room and the design permits, these tubes may run lengthwise from the forward end to the rear end of the sump or oil pan. Circulation of air is better in this case. Do not disturb the oil levels or oil troughs when doing this work.

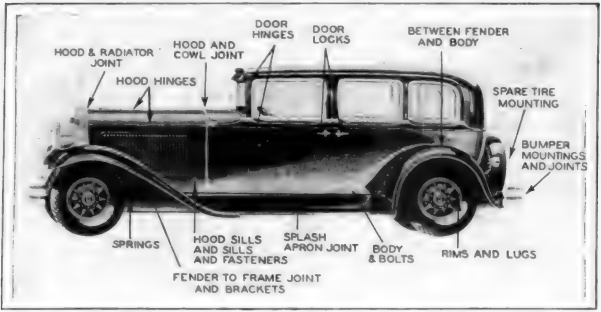
If you prefer, you can use an oil radiator. Oil drawn from the sump passes through the oil pump, then through the oil radiator where it is cooled, and from this point to the oil supply lines of the engine. In some designs provision is made for by-passing part of the oil through the radiator. Racing car drivers and motor boat racers know the advantage of keeping the oil cool with reference to bearing life and engine power. A small section of an old radiator may be used for this work. Solder a header tank on each end. Mount it in the air stream.

Another method of cooling the oil is illustrated below, in which a special attachment is made to the oil pan. It is the invention of McRae Jones and has recently been patented, and though intended particularly for automobile or airplane use, can be applied to any internal combustion motor. Tubes through which the oil must pass are provided with cooling vanes which radiate away the oil's heat to the outside air. The whole apparatus, as shown, is attached beneath the regular oil pan of the motor in such a way that the oil level and the troughs into which the connecting rods dip on each revolution, are not disturbed. Operation of the usual oil pump keeps the lubricant flowing at all times, and the number of cooling tubes insures the oil's losing its surplus heat in the quickest possible time.



Top drawing illustrates new patented oil cooling system. At right, home-made oil cooling device.

Rattles Can Be Prevented by Proper Car Lubrication



Points of the car where penetrating oil can be used to stop squeaks and rattles are shown above.

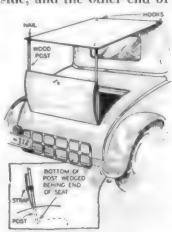
CAR owners must give thought to body service and care, as well as to the maintenance of the chassis. Squeaks and rattles are annoying. Many times rattles are due to wear which might have been prevented by proper lubrication of the body parts in the early life of the car. How often do we find car owners giving thought to lubricating the door locks and door hinges; yet if this is not done it will be a matter of a few months until rattles and squeaks are annoying the passengers. The illustration shows some of these neglected parts. Penetrating oils may be used to eliminate these squeaks. It is best to purchase recommended brands of penetrating oil, although a preparation of one-half kerosene and one-half light lubricating oil, with just a bit of plate graphite, will serve in the absence of the recommended product.

A treatment with penetrating oil should last approximately thirty days.

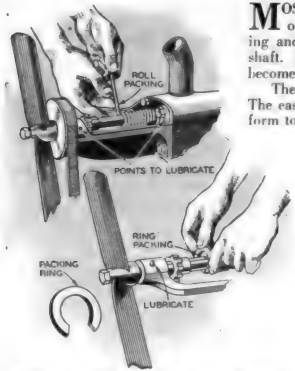
In a few words, here is the check-up: spray oil between the fenders and the body, around the bands supporting the gasoline tank, along the springs, and spring shackles—around the tire rim, around the brake toggles and pull rods, along the body pads, between the splash apron and body, around the body bolts, and along the hood sills; around the bumper mountings, along the hinged joints of the hood, between the hood and radiator and similar points. If squeaks set up in the wood spokes of the wheels, remove the wheels and tighten the bolts from the inside.

Awning for the Rumble Seat

RIDING in a rumble seat is all right as long as the weather is ideal, but not so good when it rains or when the sun beats down with Sahara intensity. At such times an awning like the one shown in the drawing below is much appreciated, and its construction entails little labor. Any suitable piece of canvas or waterproof fabric can be employed. Two hook-eyes are screwed into the top of the car frame, into which the end of the awning is fastened. Two wooden posts of the proper height are then wedged behind the rumble seat, on either side, and the other end of the awning nailed to their tops. The posts can be kept in place by strapping them around the seat. When a long trip is to be taken, the awning will prevent a bad case of sunburn. — Ray Champion.



Two Usual Methods of Packing the Water Pump Shaft



Showing roll and ring pump shaft packing.

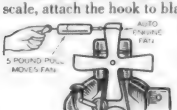
MOST water pump shafts are the source of more or less trouble. If packed too tight, the packing and accumulation of grit may score and cut the shaft. If the shaft material is of poor grade, it will become pitted from rust.

There are two forms of packing in common use. The easiest to install is the packing ring. The easiest form to secure is the packing cord or roll. The drawing shows the method of applying this packing. Wind it on the shaft in the same direction it is necessary to turn the nut or packing gland when tightening. Allow the old packing to remain on the job and tighten the new packing just snug enough to stop the leak.

The method of installing the split ring packing is also shown. Allow the old packing to remain and tighten the new packing until the leak stops. In any case it is well to inspect the job after a few miles of running, when it may be necessary to give the packing gland a partial turn to complete the job. On those jobs where grease cups are provided, see that the lubrication is not neglected. Use a grade of grease recommended by the car manufacturer.

Adjusting the Fan Belt

IN ADJUSTING the fan belt it is important that the right tension be maintained. To determine this, take a household spring scale, attach the hook to blade as shown, and the pull should register 5 pounds for the proper tension. This prevents damage to the belt or the bearing.

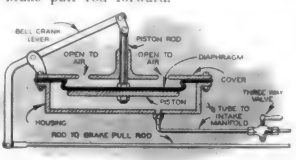


Pepping Up the Slow Engine

THERE are many slow compression cars on the market which may be helped considerably, by having the compression raised. One man at the foot of a mountain has fitted his shop so that he can plane off cylinder blocks or cylinder heads, as the case may be, on these older engines. This work may be done in any machine shop. Owners having such work done, should make sure that the pistons clear when part of the head or cylinder block has been planed off. Ordinarily, about 1/8-inch stock is removed. The newly prepared job will require the use of anti-knock fuel.

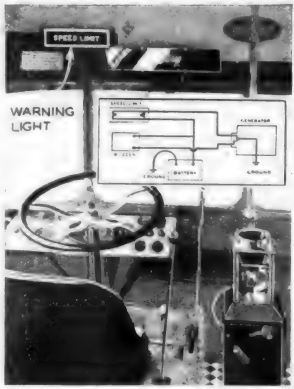
Diaphragm Type Vacuum Brake

THE illustration below shows a cross-section view of a simple diaphragm type vacuum-operated air brake. The housing should be not less than 10 inches in diameter, preferably 12 inches. The larger the diameter, the greater the leverage possible and the shorter the stroke of the piston rod. The piston may be an aluminum or steel plate. The diaphragm is made from rubberized fabric, such as is used for tire repairing. The tube to the intake manifold is connected to a hand or foot pedal operated three-way valve. When the valve is opened, to the housing chamber, air is drawn out, and the natural air pressure on the diaphragm moves the piston down, as is indicated by the arrow. This moves the brake pull rod forward.



Buzzer and Flash Sign on New Bus Give Speed Warning

A SPEED-PREVENTION signalling system that announces by sight and sound to both driver and passengers alike when the speed limit is reached is being installed in many busses throughout the country. When within three or four miles of the predetermined speed a switch on the generator is tripped, and a light reading "Speed Limit," shown in photo at the right, is flashed on, and when the actual speed is reached a buzzer, audible to all the passengers, sounds out. The system is sealed to prevent tampering, and is far superior to the old governor system.



"Speed Limit" sign and buzzer, shown above, give warning when bus reaches unsafe speed. A generator trip switch operates the alarms.

An Accurate Drill Depth Gauge

A VERY accurate gauge for measuring the depth of holes bored in metals is shown in the photo below. A small steel rod extends down into the hole beneath the flat surface of the indicator. The depth is registered on the scale in the front.

The gauge is suitable for measuring holes of any size used in machine shop work.

This depth gauge measures accurately the depth of holes.

Bench and Power Saw in One

A NOVEL and very handy device for converting a power saw into a bench saw in a few minutes has recently been placed on the market. The attachment, shown in the photo below, consists of a grooved arm fitted in a swivel base with a graduated scale for obtaining the correct sawing angle. Any kind of cut can be made with only a small adjustment of the thumbscrew, and production is speeded up rapidly. Rip and cross cut sawing are alike facilitated.

The attachment shown in photo above converts a power saw into a bench saw in a few minutes. The swivel base permits sawing at any angle.

Sunken Subs Raised with Chemicals

SUNKEN submarines will be rescued in the future by releasing a powder which reacts with water to produce a large volume of gas which is lighter than air, it was predicted by an eminent German scientist. The vessel could be lightened enough for floating by a small carton of the powder released as soon as flooding took place.

BUILD Your OWN

Dutch Bauman in his Fronty equipped Ford, redesigned by Arthur Chevrolet, has consistently won big money with his high point winning Indianapolis Speedway racing car.

WHERE do all the dirt track race cars come from? Most of them have been Model T Fords, though in recent years there have been a sprinkling of Chevrolets, and now a few Model A Fords. Most of the Ford racers, both on the dirt tracks and the speedways, have been equipped with one or the other of my Frontenac racing heads—the so-called "Fronty Fords" and some of the other special racing parts my plant has produced.

The only Fords that have ever qualified and finished in the 500 mile grind at Indianapolis have been Fronty equipped. On May 30, 1923, L. L. Corum took fifth place with a car using the Model S-R head, finishing in front of the Mercedes, Bugatti and all the other foreign cars, as well as several American entries, after qualifying at the remarkable speed of 86.92 miles per hour.

Anybody who is an average good mechanic can build one of these cars for dirt track and speedway racing for far less than the cost of a completed racer, which ranges from $2,000 to $2,700. Many of them are produced each winter in spare moments by small town garages, either for racing by the builder or for sale.

The first job in converting the Model T Ford into a dirt track racer is to speed up the motor. All moving parts, such as the transmission drums, flywheel, crankshaft, pistons and connecting rods should be accurately balanced. New bearings should be poured in the cylinder block, after plugging the original oil holes. When new bearings are machined, there should not be any relief given on the sides; in other words they should be 100 per cent full bearings with a circular groove about 1/16-inch deep and 1/8-inch wide, placed so they will register with the holes drilled in crankshaft for force feed oiling system.

Art Chevrolet says Model T improvement rests largely in motor souping. Here is his D-O overhead valve block.

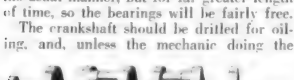
DIRT Track RACER

by ARTHUR CHEVROLET

(Famous Race Driver and Inventor of the "Fronty" Ford Head)

The connecting rod bearings should be absolutely smooth, with no grooves whatever. All bearings should be burnished in the usual manner, but for far greater length of time, so the bearings will be fairly free.

The crankshaft should be drilled for oiling, and, unless the mechanic doing the



For the Model T Ford, a counterbalanced crank or a crank of heavy dimensions is needed.

work is well acquainted with this operation it is better to send the crankshaft and transmission shaft to some shop to have it done. The transmission shaft is also drilled to a point about halfway between the two large bushings and a bleeder hole drilled to bring oil right in the center of the transmission. The centrifugal force will then supply oil to all internal parts of the transmission.

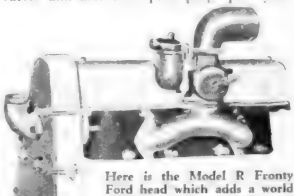
The flywheel should be machined down to about 10 or 11 inches in diameter to allow quicker acceleration and do away with the danger of the wheel bursting in case of quick racing of the motor. A steel band shrunk on the outside of the wheel after machining does away with this danger entirely. We also recommend the use of a steel plate about 1/8-inch thick, with three holes bored in it, to fit over the triple gear pins, which have to be made longer. This stops all danger of the triple gears spreading and tearing the flywheel and transmission to pieces. The spreading of triple gears is especially apt to occur when making a fast get-away in low gear.

Next, light weight aluminum racing pistons should be installed, with three narrow piston rings, the bottom being an oil ring. When ordering pistons it is necessary to give the manufacturer the exact size of the cylinder bores. Pistons of the proper clearance for racing work will then be secured. The next step is to replace the camshaft gear with an all-steel gear, as the regular Ford cast iron gear will break in racing work.

If it is desired to keep down the cost as much as possible a Tri-Unit, embodying Bosch battery ignition, oil pump and water pump can be used. However, if possible to do so, it is better to use a special bracket, which fits on the block in place of the generator, and carries an oil pump driven off the end of the camshaft with a special extension nut, with a water pump and magneto on the right-hand side of the motor.

The ignition secured with a good magneto is superior to battery ignition for racing purposes, and also does away with the necessity of carrying a battery in the car. A complete force-feed oiling system, of course, should be installed. Next comes the special overhead valve racing head.

The Model R "Fronty" head has one Zenith 1 1/2-inch carburetor, and the Model S-R, which carries 1 7/8-inch Tungsten steel valves and uses two spark plugs per cylin-

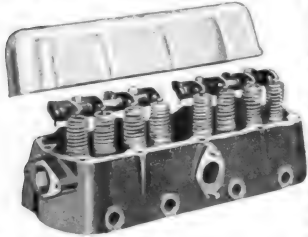


Here is the Model R Fronty Ford head which adds a world of power to a cut down and underslung Ford Model T race job. The head comes either overhead camshaft as shown, or rocker arm valve movement.

der, can be operated either with two Zenith 1 1/2-inch carburetors, or, with a special intake manifold, with one, though two are to be preferred. Compression is higher with the Model S-R head, and it answers the demand for something faster than the Model R. Those are the principal heads

in use for Model T racers, though if you want something especially fine, and therefore more expensive, there's the sixteen valve Model D-O with two overhead camshafts.

With either the Model R or Model S-R head an overhead camshaft drive can be substituted for the usual rocker arm system. It is simpler and more reliable and will add speed to a racer equipped with either of the heads.



The Fronty Ford Model R head with rocker arms. It increases compression tremendously and thus enables the motor to give much better power. The head is essential to a good racer.

After the head is in place a suitable exhaust manifold is installed.

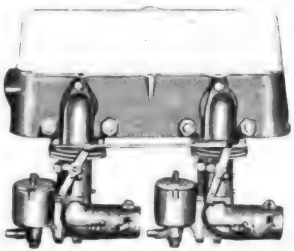
The writer also recommends that a ball bearing ball cap be used at the rear end of the transmission to replace the plain bearing ball cap. There should also be included a sub-base oil reservoir in order to increase the oil capacity of the motor to about three gallons, which is necessary if races for any distance are to be run.

When assembling the motor great care should be taken to see that the crankcase lines up correctly at the back end of the transmission, for if there should be any mis-alignment or strain on the transmission shaft when the ball cap is installed this will cause the crankshaft to break. This particular item is responsible for breaking more crankshafts than anything else. If you want to change the planetary transmission of the Model T to sliding gear a special crankcase can be purchased to take the Model A transmission and clutch. It has several advantages, including the fact that you can run your motor on dry sump and therefore have cooler oil for the bearings.

Regular metric racing spark plugs only should be used, as the regular 7/8-inch spark plug is very likely to pre-ignite.

A motor built along the above lines will be very satisfactory for a low-priced racer; however, much faster motors can be built by using more special racing parts. If you want further details about construction, parts, or other details of building a Ford Model T racer, or want information about Chevrolet, Ford Model A or Whippet parts, either for a faster road car or racing use, send your query to the writer, in care of the editor of MODERN MECHANICS.

Editor's note: In the past it has always been the policy of the editors of MODERN MECHANICS to answer in detail any inquiries readers wished to put to our facilities. With the case of this dirt track racing car material, however, should you wish additional information than is given in the article, please address your letters direct to Mr. Arthur Chevrolet, care of MODERN MECHANICS. Mr. Chevrolet has made parts for almost every conceivable type of conversion and will be glad to go into detail with all readers who are interested in making a real race car out of an old Ford. Subsequent issues of MODERN MECHANICS will go into detail concerning the "souping up" of both the Model A Ford and the Chevrolet. These articles will be by the same author and will show many of the newest developments, including underslinging and super charging.



This is the Model S-R head with dual Zenith carburetors—the answer to quick pickup which is needed for the sharp corners met with in dirt track racing.

Pedestrians Lose Last Refuge

Our artist's idea of what may happen if they start playing golf by auto.

CURTIS W. WILLOCK, of Pasadena, is inordinately fond of golf. He may never be a champion but he certainly has contributed in a large measure, to the modernization of the ancient and honorable sport. Ordered by his physician to avoid fatigue caused by the long walk around the links, Mr. Willock had a special electric car built which permits him to enjoy the game.

PLANS for Building the

Here are the wing details, fuselage and tank details of the famous Driggs Dart lightplane designed by the author. Follow this series and you will have a complete set of plans!

IN THE July issue of MODERN MECHANICS full details for the fuselage parts and the method by which this most important part of the ship is constructed were treated. This month, in this, the second part of the Driggs Dart design story, details on the wings and further data on the fuel system will be added to make the story more complete. Next month the balance of the story will be given, and then you will have the complete design, just as I turned it over to the Army Air Corps for acceptance, only minus the voluminous stress analysis.

Here is the data on the construction of the wing:

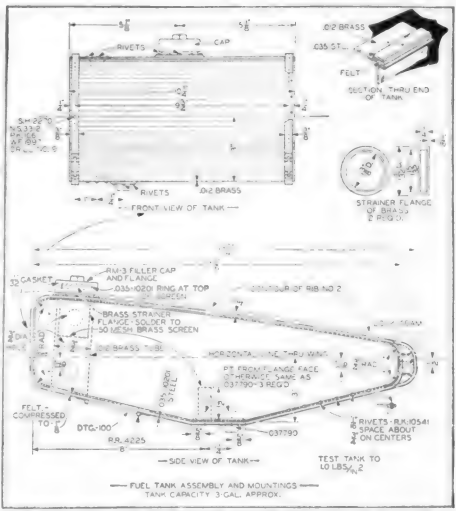
By referring to the drawing on page 158 we see that the wing of the Driggs Dart is full cantilever, that is, without external bracing, and is plywood covered. Sufficient plywood 3/64" thick should be ordered to cover the wing as shown and to make the 21 ribs. Then obtain about 84 pieces of spruce 3/16 square and about four feet long for the rib cap strips. These ribs are made of one sheet of 3/64 plywood with the cap strip nailed and glued in each side. They may be laid out on one piece of plywood and that tacked to another and then both bandsawed together. This will insure that the corresponding ribs on each side are alike. With the rib contours sawed

As furnished to the army for experimental work on wing slots the Driggs was powered with a Wright Morehouse opposed engine of 30 h.p. Note the triangular rear fuselage cross section.

DRIGGS DART

by IVAN DRIGGS
famous plane designer

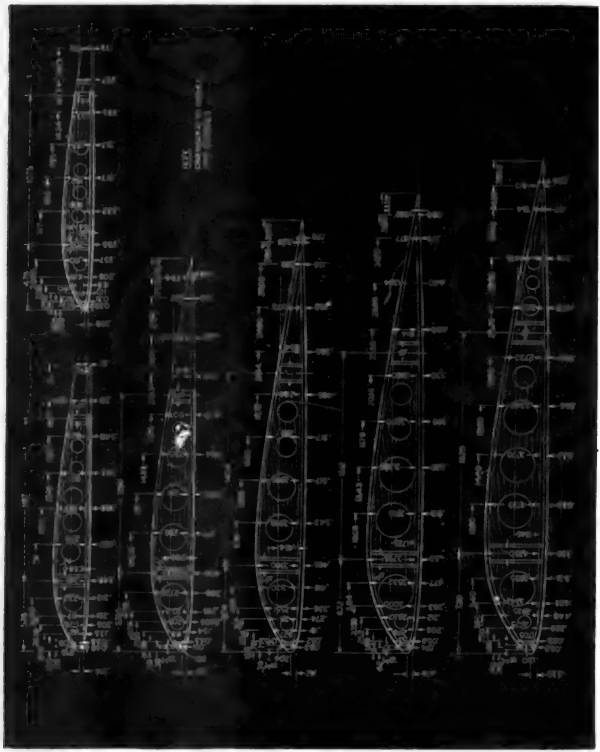
from the plywood each size is lightly tacked down on a smooth plank and about a dozen ½x-½x1-in. blocks are nailed to the plank around the outer edge of the plywood, as closely to it as it is possible. After the blocks are nailed to the plank so as to form the rib jig the 3/16 square pieces are glued and nailed to the plywood. Use the best grade of casein glue. Force the cap strip out against the blocks with the fingers to insure that the proper contour is obtained. It will be necessary to soak the strips for the deeper ribs at the nose in hot water to make the bends without breaking the strips. When the strips are applied to one side of the plywood pry off the plank and apply the strips to the other side by constructing a similar jig, but of opposite hand. When the ribs are dry they should be cut out for the spars with a sharp knife and neatly trimmed and sanded. Do not varnish at this stage.



Here are the complete details for the beautifully engineered design of the wing tank. All dimensions are given. It would be wisest for the amateur builder to take this job to his local tinsmith, who will build it for him.

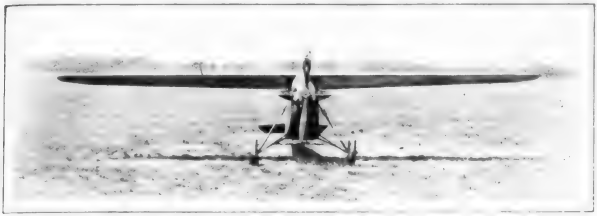
The next problem is to make the spars. This is where the services of a good cabinet maker will be necessary. From your local mill obtain some planks ¼"x7"x12 feet, and some ⅛x4x½ from clear spruce. This material need not be especially the airplane quality, but should be free from knots and reasonably straight grained. Then obtain two 6"x8"x14 ft. beams and two planks 2x8x14 ft. for use as cauls. Spike these beams end to end onto about six saw horses. Be sure that they are perfectly level and without any twist. They should be perfectly straight. By referring to the wing drawings we see that the different laminations of the spars stop at different intervals from the center. Lay off these intervals on the beam and cut the outside lamination from the front spar, laying one of these pieces on the beams and securing it with a few small brads. Place two separate pieces outboard of this center lamination the remainder of the length of the beam. Also brad these pieces down. Cut the next lamination and lay it on the first, using shorter filler pieces at the ends. Continue until all of the spars laminations are cut. You will note that the center four lam-

Every Measurement for Half of Ribs Is Given in Blueprint Below



The wing ribs are made of 3/64-inch plywood. Two are made from each of these dimensioned drawings, thus assuring identical cross sections of both wings. Cap strip run on each side, in profile.

inations are continuous and that your material is not long enough to reach. Each lamination may be spliced taking care that no two pieces have a splice closer together than about two feet. A good scarf splice should be made using a slope of about 1 in. for the 1/8-inch plank. When the laminations have all been cut and spliced they should be glued together by applying the glue to the shorter planks of

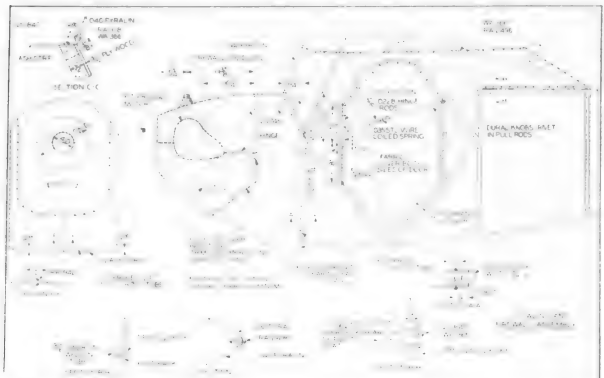


Loading per foot of span on the Driggs Dart makes it a much better rough weather ship than most any of its contemporary lightplane brethren. The undercarriage and cabin are advanced ideas.

any pair. That is, apply the glue to the first plank and lay down the next. Apply to the third and so on. Fill the ends on top with ¼ planking cut-offs and firmly clamp on the two 2-in. planks above mentioned. Use about four dozen 12-in. C-clamps. Allow the spar to dry about 24 hours before removing from the caul. Be sure to use casein glue only. When the clamps are removed you have your front spar ready to work down.

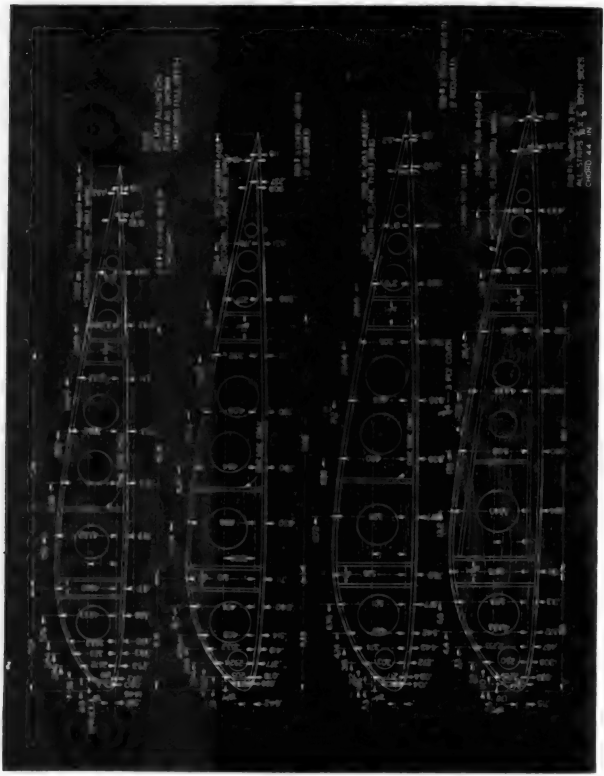
The rear spar is made from the four inch planks in a similar manner except that the beams are raised up at the tips to take care of the bend in this spar as shown. This is accomplished by blocking up each successive saw horse until the beams make the proper included angle. Then a piece of soft wood should be screwed to both planks in the center and worked down by hand to form the proper radius for the bend of the spars. After the caul is thus made proceed exactly as for the front spar.

After the spars are made and dried the



Here are more intimate details of the forepart of the fuselage to supplement the fuselage plan given last month. You will note the general shape of the cowling and the method of fitting the door.

Dimensions for Balance of Wing Ribs; Note Increasing Spar Sizes

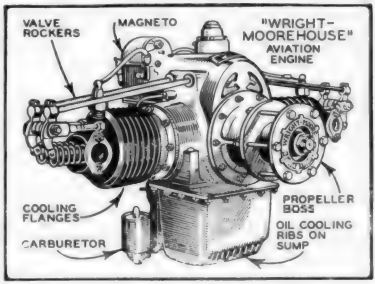


Above you will see the template measurements for the larger wing ribs in near the base of the wing. These are likewise made up of plywood with the web strips fastened outside.

next step is to lay out a center line on the spars and then lay out the heights of the spar at each rib point from the rib drawings. When this is done the spars may be sawed approximately to these points and worked down by hand so that the ribs will slip in place. These lines marked, horizontal plane on all ribs should be marked

on the spars, especially on the rear since it is the same as the center line on the front. On the rear spar this line is somewhat above the center but is perfectly straight.

When the ribs have been properly fitted the whole assembly should be clamped to the saw horses in an inverted position and blocked at various points to insure that the two lines on the front and rear spars are perfectly level. Then glue and brad the ribs to the spars in the proper locations. Glue a strip of spruce 3/16x3/8 between each rib along the center line of the spar at top and bottom so that the cover will have an attachment to the spars. Shape the leading edges of all ribs to a straight edge and apply the spruce leading edge piece, gluing and nailing to each rib. Then apply the plywood cover to the bottom surface, gluing and nailing to each rib. It is well to cut each panel before applying and to work from the tips inward. Make all splices in the cover at the ribs by lapping about 3/4 inch. When the lower surface has been applied and the glue has had an opportunity to dry turn the wing over and apply two coats of good spar varnish to the inside, except to the tops of the spar strips and the ribs. Again block up the wing so that the base lines are level and apply the top cover. Make sure the blocks and the aileron hinges and aileron pulley brackets are glued in before the cover is applied. When the wing is thoroughly dry apply the balsa leading edge and form the contour by hand. Sand the wing and cover the trailing edge with cloth on which apply four coats of dope. The cloth is tacked to the rear spar and the joint covered with rib tape. Glue rib tape over the leading edge balsa and apply two coats of spar varnish over the whole wing.

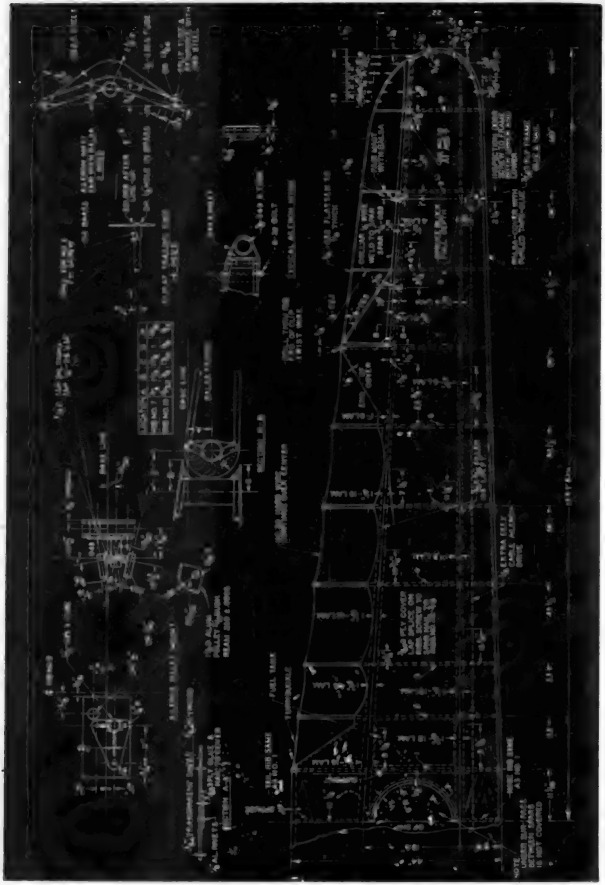


This is the famous Wright Morehouse lightplane engine, now no longer manufactured by the Wright people of Paterson, N. J., which powered the original Driggs Army Dart.

Before the wing is sealed up the fuel tanks must be built and installed. Any good tinner can make up this tank when

This will give you a fine idea of the trimness of the ship and the manner in which the cabin joins the clean cut three cornered fuselage craft of the cabin. The landing gear on this, the Henderson powered Dart, is like Ed Heath's and was the forerunner of that type.

Complete Wing Plan and Fitting Detail Drawing Show Built Up Spars



the filler caps, etc., have been machined up for him. No description of the method of making this tank is necessary since a person constructing this airplane would much better turn this job over to his local sheet metal shop.

Previously we have described the method of building all of the structural parts. Now we will describe the construction of the fuel system and of the cowling, together with a table of the source of supply of suitable material.

In installing the fuel system only ground union joints should be used, except between strainer and carburetor where we have shown a hose connection. Care must be taken so that the lines always have a downward slope so as to avoid any possibility of air pockets in the tubes. Bends should be very carefully made and not too sharp or the tubes will be considerably flattened and reduced in area at the bend. Thoroughly anneal all tubes with torch after bending and clean out all scale. The type of fuel level gauge shown is the most simple and reliable. Naturally one should be used for each tank. In making the union connections be sure to thoroughly sweat the ends of the tubing before trying to solder on the nipples. A line of solder around the tail of the nipple is not sufficient to hold the joint. If these instructions are carefully followed you should have no trouble with the fuel system.

Appearance Depends on Care

The good appearance of your ship depends upon the care with which the cowling is made. A person sometimes gets too anxious at this stage and slights the final finish. To properly make the cowl a form should be made to which the pieces are fitted while bumping. If this form is well made and the parts fitted to it carefully, you cannot help but get a good job. If the builder knows nothing about bumping or forming metal the services of an automobile body repair shop had best be enlisted. With a power hammer a much smoother job can be done and in less time.

The cowl sections should be laid out on ¾x4 Yellow Pine boards and suitably held together by four longitudinal pieces notched into the section formers at the top and bottom and two sides. The angular section for the lower part of the firewall should also be set in. This form should be well screwed and glued together and properly braced so that it cannot be sprung out of shape when being worked upon.

You will note that the cowling is made in three parts, an upper and lower motor cowl and a fuselage cowl. By forming these pieces separately rather than the whole cowl in one piece will considerably simplify the work. The firewall is laid off the same way the cowl former bulkheads are made, and is screwed to ash bending around its outer circumference. These bendings serve to fasten the firewall and front fuselage cowl together.

We believe the drawings are sufficiently clear that this cowl can be made with but little trouble if the bumping form is properly made as above outlined.

In order to eliminate the purchase of improper materials the following table is given. Naturally other sources of supply of stock are available but the writer has purchased stock for these airplanes from the sources given and feels certain that good material will be obtained from them.

Plywood—Carrom Co., Ludington, Mich.

Fabric—Johnson Airplane and Supply, Dayton, Ohio; Nicholas Beazley Airplane Co., Marshall, Mo.

Wire—John Roebling Sons Co., Trenton, N. J.

Bolts, Nuts, etc.—Nicholas Beasley Airplane Co.

Fuel System Parts—National Steel Products, Dayton, Ohio; Lunkenheimer Co., Cincinnati, Ohio.

Steel Copper Tubing—Service Steel Co., Detroit, Michigan; Edgar T. Wards Co., Detroit, Michigan.

Spruce—Posey Lumber Co., Hoquiam, Washington.

Aluminum Sheet — Aluminum Co., of America, Detroit, Michigan; Steel Sales Co., Chicago, Illinois.

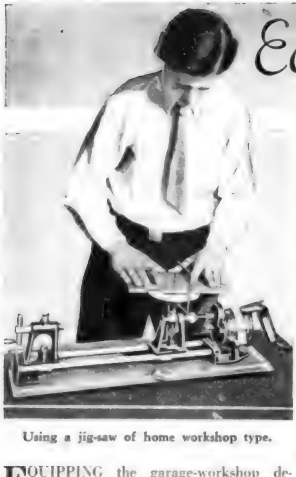
Celluloid—Celluloid Corp., New York City.

Dope—Van Schaack Bros., Chicago.

Lacquer—Berry Brothers, Inc., Detroit, Mich.; American Paint Co., Chicago, Ill.

The writer hopes that with these drawings and the above explanation any one with fair mechanical ability will be able to build the Dart I. He will be pleased to hear from persons starting construction and would like photographs when the ships are completed.

Equipping the



Using a jig-saw of home workshop type.

by JAY EARLE MILLER

Last month Mr. Miller presented plans for a two-car garage designed for Modern Mechanics readers. This month he shows how to go ahead and equip part of the garage with benches and tools so that it will make an excellent home workshop. Pointers on building a tool cabinet and workbench, and arranging the shop, are included in this article.

EQUIPPING the garage-workshop described in last month's issue depends largely on the type of work you want to do, and how much you want to spend. You can start with one workbench and a modest outlay of hand tools, and gradually add more equipment, including power tools, with their benches and stands until you have a complete shop.

Money can be saved by building your own benches and tool cabinets, as described in this article.

There is room in the two-car garage for a good engine lathe, bench type, a power combination including a wood turning lathe, sander, emery wheel, buffer, 4-inch planer and jointer, circular saw, and jig and band saws. Several manufacturers produce this equipment in sectional units, so it can be purchased a piece at a time, starting with a motor and a single tool and gradually assembling a full workshop as you can afford it.

The best place to start laying out the shop is with a wood working bench and tool cabinet. The bench for which drawings are shown has a built-up maple top, tail and head vise, tool pan and rack, and compares favorably with the finest manufactured benches. To build it you will need, for the top:

Fourteen pieces of hard maple, 1″x2″x50″; 1 piece, for the tool pan, 7/8″x8 1/8″x18″ and 1 piece, 7/8″x4 1/2″x48″.

The fourteen strips are glued together to form a top 14″ wide, and after the glue is set the ends are cut off, giving a top 48″ long, by 14″ wide. The top surface is planed down after assembly and then sanded.

The frame consists of four legs, 1 3/4″x2 3/4″x22″; 2 stretchers, 1 3/4″x4″x27″; and five pieces, for the top and bottom of the legs and the tail vise end, 1 3/4″x2 3/4″x21″.

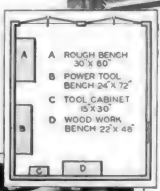
Two of the latter, for the feet, are shaped as shown, and the legs attached to the top and bottom pieces with dowel rods, held by glue. The stretchers are cut to exact length, drilled through the ends to take six-inch draw bolts, and notched in the back so that the nuts can be inserted. The notches are cut only to sufficient depth to admit the nuts, and do not show from the outside.

The top is attached with 1/2″ lag screws. The tool pan may be screwed down from the top with countersunk screws and the holes plugged with dowel rod.

The bench is finished with one coat of boiled linseed oil and two coats of white shellac.

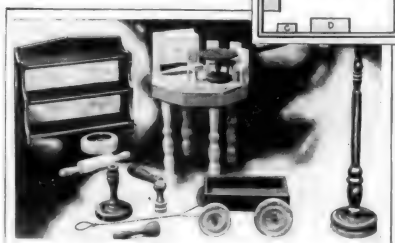
Garage Shop

A tool cabinet in which the contents can be kept in place and securely locked against pilferers and borrowers is a necessity. A good cabinet with large capacity in a fairly small space can be built with double-hinged doors, the wings opening out when opened and providing space for bit and chisel racks and other small parts. The size depends on how many tools you have, or expect to acquire. A good size for a fairly complete set of carpenter's tools is 4 feet high, 30 inches wide and 15 inches deep. It can be attached to the wall, and, when the doors are opened, there is 43 inches of tool space on them, in addition to the 28" in the back of the cabinet. The details are shown in the tool cabinet drawings.



Turning a gavel handle on a workshop lathe of the type suitable for the garage shop. Sketch at left shows a suggested workshop arrangement.

Either pine, poplar, or any other available wood may be used. The shiplap joints make it dust proof, or ordinary wide tongue and groove flooring can be used.



Typical products of home workshop show ingenuity of design.

For power tools a stronger bench is needed than for light woodwork, and it should be secured to the floor with angle brackets secured to bolts set in the cement. A bench which the South Bend Lathe Works recommends for their medium size bench lathes will be suitable not only for engine lathes, but for other power tools.

The bench has a built-up top of hard maple, 1¾" thick by 2" wide and 72" long; with six legs, 2½" by 3"; a lower shelf resting on end stretchers, and sturdy upper stretchers running lengthwise beneath the top, all assembled with bolts and lag screws. The upper stretchers can be placed far enough down to allow tool drawers to slide over them. Legs 25" long, with the 1¾" top will give the right height for an engine lathe or most power tools.

A rough bench for a heavy vise and machine shop work can be built up with 4"x4" legs, 2"x4" stretchers, and a top of three 2"x10" planks, fastened down with countersunk lag screws and the holes plugged with dowel rod. Length is optional, depending

This Neat Tool Cabinet Helps Keep Shop Equipment in Good Order

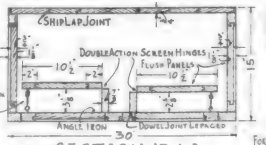
on the space available. Drawers for all the benches can be purchased ready made from the mill, or salvaged from old furniture, at a considerable saving of labor.

If several power tools are to be used a line shaft and a single motor will be cheaper, in the long run, than buying an individual motor for each tool. With the power equipment assembled on one bench the shaft can be mounted underneath, and the belts brought up through slots in the bench top. If some of the tools are on their own bases, such as a grinder, planer, or circular saw, or the saw is to be placed out from the wall for ripping long boards, it is easier to use an overhead shaft. Most tool manufacturers supply brackets, shaft and mounting instructions.

With the twenty foot span of the garage 2"x8" joist, set on edge on the plates at either side, will be needed to support an overhead shaft. Iron hangers, fitting over the joist and holding 2"x4" studding, running lengthwise, parallel to the shaft, can be obtained from a hardware dealer, and the shaft brackets bolted to the studs. This gives a firm foundation to take up the vibration. In lieu of the hangars the studs can be bolted to the joist, with ½" bolts 12" long.

If you use an overhead shaft the motor can be mounted on a wall bracket up under the ceiling where it, and its belt, will be out of the way. The usual motor for a small shop of this sort is a 2 h.p. one, rated at 1750 r.p.m., driving a line shaft through pulleys giving a reduction to 250 r.p.m. Shaft hangers with a 14" drop will carry pulleys large enough for this reduction, and pulleys to permit any desired speed change between shaft and the tool.

If you want further details about benches, tool cabinets, power tools, or working drawings for shop equipment, write the author in care of MODERN



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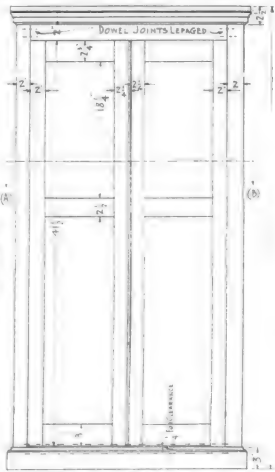
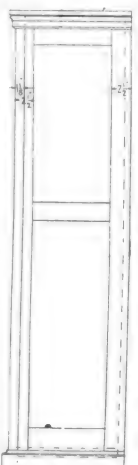
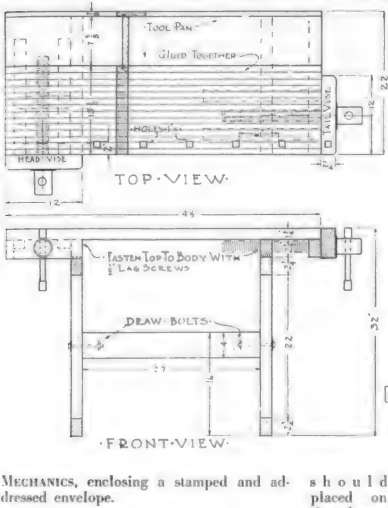


·FRONT·VIEW·



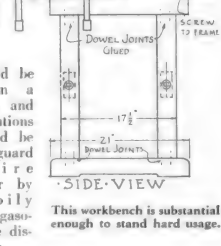
·SIDE·VIEW·

This plan gives dimensions of an excellent tool cabinet that will keep everything in its appointed place.



1/3 h.p. motor, and a scroll saw, can be purchased for $56, or the lathe alone for $27. Once the shop equipment has been installed, the uses to which it can be put are limited only by the ingenuity of the user.

In case you are building your workshop-garage in a climate where the winters are severe, the building will have to be heated to make its double purpose practicable in the winter time. The addition of a stove in a corner of the building will solve this difficulty, though of course the plans of the garage will have to be altered to allow for a stove-pipe or chimney. The stove



This workbench is substantial enough to stand hard usage.

MECHANICS, enclosing a stamped and addressed envelope.

As will be seen from the photo on page 161 of articles turned out in the home workshop, a lathe is one of the most indispensable pieces of equipment for the woodworker. The articles which can be turned out are endless and they give the workman an adequate opportunity to exercise his creative skill in design. A number of manufacturers, whose names will be forwarded to you on request, furnish workshop equipment which can be bought in units—that is, jointer, circular saw, etc., can be purchased separately as the need may arise.

To give some idea of the approximate cost of this shop machinery, a few representative prices are given here: Jointer, $25; circular saw, $25; sanding attachment group, $9.50; grinding and buffing attachment, $3; lathe attachment group, $9; scroll saw, $12; ½ h.p. repulsion induction motor, $31.75. One representative manufacturer of workshop parts delivers a complete combination, including two motors for about $165. A lathe with a should be placed on a zinc base and precautions should be taken to guard against fire danger by keeping oily rags and gasoline a safe distance away.

Weatherstripping around windows and doors to insure tight connections will aid in keeping the shop comfortable in below-zero weather. If only one set of doors is used in driving the car into the garage, the other can be kept permanently shut and well insulated against wintry winds. Of course, it is a truism to repeat that the better built the garage is, the more snug will be the weather-resisting qualities.

Good lighting not only makes the shop more pleasant to work in, but also improves the quality of the work produced. Provide plenty of light outlets!

LOOPING the LOOP

Diagram shows the mechanics of the glider loop. With a strong tail wind the pilot dives to get up speed. Pulling the stick back sharply brings the nose up and stalls the glider, which is then pulled over backward by the weight of the pilot. Insert shows Ed Heath, the first to perform the loop in a motorless glider.

The impossible has been accomplished again! To Ed Heath, America's pioneer in designing, building and piloting light planes, goes the honor of first looping the loop in a motorless glider. How this thrilling stunt is accomplished is described here by the designer of the Baby Bullet.

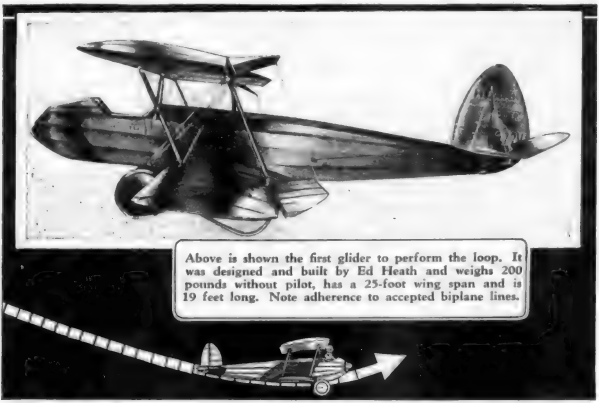
MOST all pilots who have had considerable air time realize that an airplane traveling close to the ground down wind can be put into a vertical bank and face about into the wind without loss of altitude. They very early in their experiences also found out that it was impossible to reverse this condition without fatal results. That is to say the plane cannot be flown into the wind, then quickly turn with the wind close to the ground. It is because of this factor that so many accidents occur from pilots attempting to turn back to the field after the motor has given trouble, whereas they could have landed safely on bad ground dead ahead into the wind.

This same condition prevails at any altitude although it is not noticed except when close to the ground. This may be readily proven by taking an airplane to a height of one or two thousand feet, flying it horizontally down wind for some distance without gaining altitude and reading the altimeter carefully. Then making a quick vertical bank into the wind it will be noted that the altimeter will show no loss of altitude.

Reversing this condition, that is by flying into the wind and reading the altimeter

In a GLIDER

by **ED HEATH**
Father of American Light Planes



Above is shown the first glider to perform the loop. It was designed and built by Ed Heath and weighs 200 pounds without pilot, has a 25-foot wing span and is 19 feet long. Note adherence to accepted biplane lines.

carefully the pilot will then find by making a vertical turn back down wind that the plane has a marked tendency to spin and at best will dive before it can again be flown horizontally. Now reading the altimeter, a loss of 400 to 500 feet will be noticed, this varying according to the wind velocity as well as the suddenness of the turn. It is this wind force that can be used to hinder or help the pilot in flight. It was this wind force that was utilized in looping of the glider.

Unlike an airplane the glider stalls almost instantly when not kept in a normal glide or when the tow rope slackens. This is due to the fact that the resistance of the glider is comparatively high in proportion to its weight.

You can visualize this best by towing a piece of paper and suddenly slackening the string. It does not keep on traveling but stops almost instantly. Bearing in mind these laws it is impossible to loop a glider in still air, as no matter how far you dive it will only obtain a speed at which acceleration of gravity is balanced by the resistance of the plane and the minute the plane is pulled up from the dive it is in a stall. Therefore, to loop a glider, it is essential that a high wind prevail and that the glider be traveling down wind.

The speed of the wind must exceed the flying speed of the glider. This means that the glider has a rolling moment or what we may say a traveling speed in relation to the earth at least twice that which is required to keep the glider in the air. In this condition the glider may be suddenly pulled upward. It is now in a vertical position and lost its flying speed.

The only concentrated mass or weight to the glider is the man. With this mass at the top the tail is then swept on and out from under the glider. This rotates the nose in the direction of the wind and as the glider noses further over on its back it is heading into the wind and again assumes flying speed although it has lost rolling moment. As the wind is in excess of that required for normal flight it has flying speed, therefore the controls are completely affected and a perfect loop can be made.

Lighthouse Warns Motorists — To Fill Their Gas Tanks

Gas station modeled after famous lighthouse.

SOMETHING new in the way of lighthouses is the filling station which stands at one of the main intersections of the famous whaling city of New Bedford, Massachusetts. The station fits well into the old fishing village type of architecture of the city and is modeled after the old Butler's Flat light in New Bedford harbor. The light, instead of warning vessels of rocks and shoals, warns the passing motorist to fill his gas tank.

Everything But the Smoke Stack

AN ORDINARY stock sedan has been transformed into a choo-choo and is used by the Northern Pacific Railroad as an inspection car. The only alterations necessary were the addition of head and rear lights and a cowcatcher and the substitution of flanged railroad wheels for the usual rims and tires. The car runs on regular schedule the same as real trains. Steering is unnecessary as the flanged wheels follow the rails without guidance.

Sedan is fitted with flanged railroad wheels.

Pocket Photometer for Movies

A POCKET photometer of entirely new type, said by the manufacturers to mark the greatest advance in exposure meters in the history of photography, has recently become available to photographers.

The device is based upon a simple laboratory method of light intensity measurement, the brightness of the filament in a small electric light is made to match the brightness of the object to be photographed. The brightness of the filament is controlled by the simple operation of turning a dial. The direct comparison of the brightness of the filament with that of the subject, as viewed through the eyepiece, permits a quick and direct reading, taken from the dial, of the lens diaphragm opening to be used.

This method is unique in that it permits finding the exposure while actually seeing the subject. This makes it possible to determine the exposure required to register shadow or dark details, or highlights and light area details, or to strike an average exposure between the extremes. A simple adjustment corrects the instrument to the operator's own vision.

Marconi, 10,000 Miles Away, Opens Sydney Power Plant

WHEN the newly installed lighting system of Sydney, Australia, was recently inaugurated for public use, the signal for the formal switching on of the current was given by Signor William Marconi, the famous inventor of wireless, who was at the time aboard his yacht, the *Electra*, which was riding at anchor in the harbor of Genoa, Italy, more than 10,000 miles away from Sydney.

The signal was flashed by the powerful radio transmitter of the *Electra*, shown in the photo at the right. Traveling almost half way around the world, the signal was intercepted in Sydney and the huge generators of the new power plant were set running. Signor Marconi was accorded this honor as a means of celebrating his part in the construction of the plant.

Located on his yacht in Genoa, Marconi sent a radio signal 10,000 miles, opening the Sydney power plant.

Radio Tube Without Hum

Photo of the new radio tube which eliminates A.C. hum, and its inventor, Mr. B. F. Meissner.

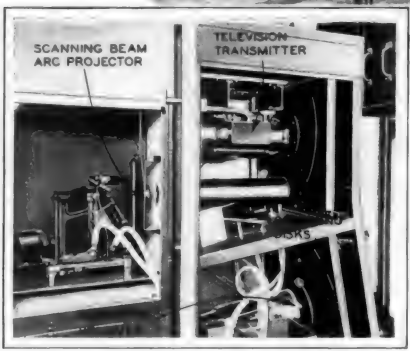
RADIO sets using alternating current for filament and plate supply have always suffered from a troublesome humming which could not be eliminated. Benjamin F. Meissner, the famous radio wizard, however, has at last perfected a tube which does away with the hum. The new tube, Mr. Meissner asserts, will revolutionize radio reception, doing away with a difficulty that has long checked radio development.

Ads Stenciled on Walk with Water

AN INGENIOUS device which paints signs on the sidewalks, but which in no way permanently defaces the street, is used by a Barcelona wine merchant to advertise his products. The ad painter consists of a large rolling drum filled with water and enveloped in a stencil. As the drum rolls along the water emerges around the stencil and paints an outline of the letters on the walk. As the water evaporates in a short time, no damage is done. No signs, however, can be painted on a rainy day.

TELEVISION Now Gives

These engineers are testing television's practicality. At the rear is the television projector which picks up the image of the speaker's face.



The television apparatus is concealed in the front of the booth, as shown above. The speaker's face is scanned with the disc above and the received image is reproduced on a screen with the disc beneath.

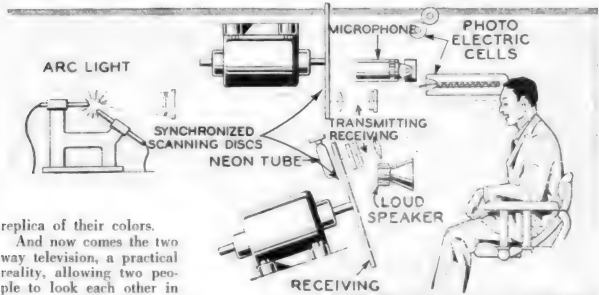
TWO way television, whereby two persons at opposite ends of a radio circuit may see images of each other as they talk, has finally become a practical working reality.

Before a group of skeptical witnesses the practical application of television was recently demonstrated by engineers of the American Telegraph and Telephone Company at their laboratories in New York City.

Although television is as yet outside the limits of commercial exploitation and cannot be used in homes as are broadcast receivers, the engineers are confident that this new radio development will be as popular within the next three years as is broadcast music now.

Back in April, 1929, the possibilities of television were first realized when President Hoover's face was "televised" from Washington to New York City. Then the next year Dr. Herbert Ives, head of the Bell Telephone Research Laboratories, reproduced via television, an outdoor tennis game. In 1929 television made another stride forward when colors were sent over the wire. A watermelon and a red rose were reproduced at a distant station with a perfect

Radio EYES and EARS



replica of their colors.

And now comes the two way television, a practical reality, allowing two people to look each other in the eyes as they talk.

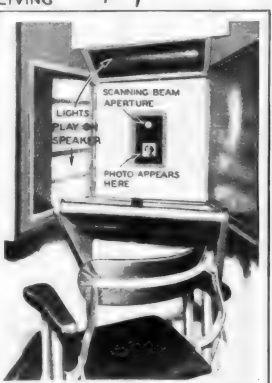
At the recent test the demonstrator entered the three-sided television booth and seated himself in a swivel chair, facing a glass screen about a foot square, and marked with the words "Ikonophone—watch this space for television image." Above was a small aperture through which the scanning beam played on the speaker. Behind the booth, though all invisible to the speaker, was concealed the intricate transmitting and receiving apparatus, only the frame and the aperture being visible.

When the current to the apparatus was turned on and transmission about to begin, the face of the demonstrator became illuminated by a faint glow of blue light which was given off by the photo electric cells stationed at various points around the booth. These photo electric cells, known as "radio eyes," are the means whereby the image of the speaker is picked up and transmitted to the distant receiving station where the other speaker is seated.

Even though the speakers were situated three miles apart, it would not have made a particle of difference, the engineers stated, if they had been located an entire continent apart.

When transmission begins the words on the glass frame facing the speaker vanish as if by some magic trick, and there appears the animated image of the speaker at the other end of the circuit. The features are sharp and distinct, and are shown forth in black and white on a pinkish background.

While the demonstrator was watching the figure of the other person, his face was in turn being scanned for transmission—that is, his features were being swept 18 times a second by a scanning beam and



Above: A diagrammatic sketch of the combined radio and television apparatus. The voices and images of the speakers are being transmitted simultaneously. Below: Booth with the photo-electric cell lights which pick up the man's image, and the reproducing screen.

Maps Televised From War Planes Show Maneuvers of Enemy Forces

The television station aboard the army airplane from which maps of enemy territory and movements were sent during air maneuvers. At right is the receiving cylinder reproducing the map.

transmitted by the impulses set up in the light sensitive photo-electric cells above his head. The flickering blue light created by the cells is in reality very bright, and would be hard on the eyesight, were the rays not run through a blue glass, creating a light to which the human eye is insensitive.

When the demonstrator speaks his voice is picked up by a microphone concealed overhead and the other speaker's voice is in turn reproduced by a loud speaker, also concealed within the booth.

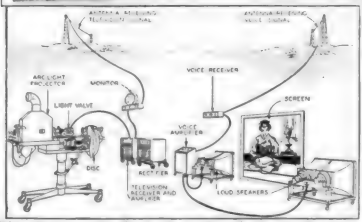
Television has also proved its serviceability for war time use in the recent air maneuvers held at Mather field. Here the entire activities of the planes were directed by radio, and maps of supposed enemy territory were charted out by a plane flying over the area and transmitted by television to the headquarters.

The above map, sent by television from an airplane gives some idea of the value of television in wartime.

The chart was placed on a television cylinder in the plane and the details of the map were picked up by a photo electric cell and transmitted to "GHQ", where another synchronized disc reproduced the chart, thus informing the commanding officers directly as to the nature and position of enemy forces.

Television Movies Brings Distant Program to Theater

A photo of the television equipment, showing receivers, projector, screen, and loud speakers, set up in the Schnectady theater for the first television movie show in history.



This diagrammatic sketch shows the television and radiophone receivers which bring in both signals simultaneously, thus giving synchronization to the voice and the image.

THE latest and most spectacular advance of television equipment took place recently at a vaudeville theatre in Schenectady, which the General Electric leased for a demonstration of television movies. This performance was the result of years of experimentation on the part of Dr. E. F. W. Alexanderson and his colleagues.

When the curtain parted, revealing a six-foot screen, Dr. Alexanderson stepped forward and modestly announced that the audience was about to hear and witness on the screen television images and voices of vaudeville actors performing at his laboratory about a mile away.

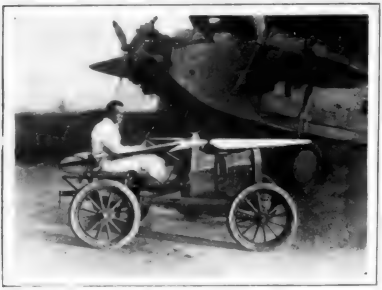
Immediately a pair of black faced comedians appeared on the screen cracking jokes and doing a song and dance. Then the leader of the orchestra appeared on the screen, baton in hand, and directed his orchestra which was located in the pit.

At Dr. Alexanderson's studio, images of the performers were being picked up by photo electric cells, and the television signals created by the light impulses broadcast along with the voices of the entertainers. At the theater where Dr. Alexanderson was acting as operator of the television movie projector, the voice and image signals were received simultaneously, the voice signals issuing from the loud speakers, while the television signals were transformed into light impulses, which controlled the projector beam.

A small device called a monitor teloptiron transformed the radio waves into the electrical impulses which operate the sensitive light valve in the projector. This valve, a recent invention which makes television movies possible, controls the light from the arc, which is projected through the valve and the rotating disc. This disc breaks up the light in synchronism with the scanning disc at the transmitting station.

The entire television and voice receiving apparatus was located behind the screen.

Auto Is Convenient For Handling Airplane Propellers



Tread is narrowed to 48 inches and wheel base is shortened.

ON EVERY aviation field there is a problem involving the transportation of propellers between planes and shops. This problem is particularly difficult on fields where triple-motored planes with three-blade propellers are used, for after these propellers are taken into the shop to be trued and balanced they will not stand any rough handling in being returned to the plane.

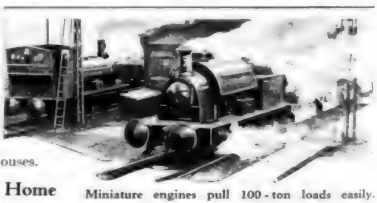
The Western Air Express has solved this problem very satisfactorily at its Los Angeles Terminal (Alhambra, California) by the use of a cut-down, T-model Ford car, rebuilt especially for the job of handling propeller. It is provided with a steel post on which the propellers are set for being transported between planes and shops. This steel post has a "fire hose type" of screw fastening so that the work of attaching and detaching the propellers is but the work of a few seconds. The narrow tread and short wheel base of the car give it tremendous maneuverability both on the field and in the shop.

Blanched Copper Easily Made

BLANCHED copper as used for clock dials, thermometer and barometer scales, etc., is an alloy of 91 per cent copper and nine per cent arsenic. It is made by heating copper strips or chips with white arsenic in an earthenware crucible, putting them in alternately and covering the top with common salt as a flux before heating.

London's Smallest Railway Hauls Three Thousand Tons of Coal Daily

FEW Londoners are aware of the existence of the fifteen miles of track on the private railway owned by a large metropolitan gas company. The railway operates nineteen miniature locomotives, has its own branch lines, signal boxes and depots, and hauls over 3,000 tons of coal daily for distillation into coke and gas for over 400,000 houses.



Miniature engines pull 100-ton loads easily.

Catches Supper on Way Home

ONE of the most unusual uses for the ordinary male fedora has been adopted by Kenneth Watson, of Baltimore. He always carries a few fish hooks in his hatband, while in his car is a fresh batch of worms and a collapsible fishing rod. When he leaves his office of an evening he stops at nearby streams, removes his hat and selects a hook. By dark he is home with fresh brook trout for supper.

Flashlight Cause of Explosion

INVESTIGATIONS have revealed the fact that an ordinary electric flashlight, usually considered safe for working around explosives, may cause a serious accident. With one detonator wire connected to the plunger switch, the other wire coming in contact with a lighted torch will always cause an explosion.

Dentists' Articulator "Breaks in" False Teeth Painlessly

"BREAKING IN" a new pair of false teeth is usually a painful and uncomfortable business and looked forward to with considerable dread by those subjected to the atrocity. However, thanks to the ingenuity of inventive dentists, the difficulty has been solved by the use of the articulator shown in the photo at the right. The false teeth which are later to be used in a human mouth are inserted in the articulator and set to work at being "broken in."

New false teeth are inserted into this articulator and "broken in" for the patient without pain.

A Labor Saving Electric Mixer

A HANDY and labor saving device designed to conserve the energy of housewives has been put on the market in the form of a mixer or beater, known, according to its trade name, as a Mixabeater. The stirring is done by motor driven twin beaters, the speed of which can be varied. The device does a thorough job and can easily be cleaned after use.

This motor driven mixer is speedy and thorough.

Heating Increases Brain Power

MAKING one's head into an electric heater in order to think better and more rapidly has been suggested in Germany as a result of recent experiments by an eminent scientist on the application of the new process called diathermy to the brains and nervous system of animals and men.

Diathermy consists in passing through any part of the body electric currents which are harmless but are converted partly into heat so that the tissue which receives the current is warmed. In the German experiments currents were carefully applied to the living brains of men and animals by means of electrodes outside the skull. By testing muscular responses and other bodily actions it was discovered that such internal heating greatly stimulates the activity of the brain and makes other actions of the nervous system more active and effective.

Auto Pump Cleans Typewriter

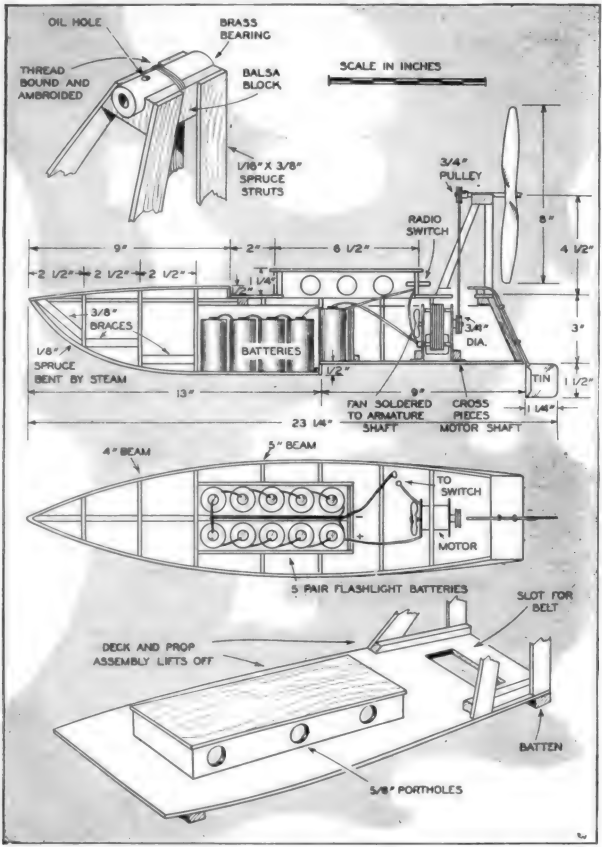
THE process of cleaning a typewriter is rather tedious if a cloth is used for the job. A quicker and more thorough job may be done with an automobile pump. The powerful strokes of the pump blow the dust away and the machine is cleaned in no time.

Sand Extinguishes Cigarettes

THERE are hundreds of cigarette lighters on the market, but what the country needs is a cigarette extinguisher. Such a device is shown in the photo at the right. A small metal receptacle is merely filled with sand and kept in the cigarette tray. The burning end of a cigarette, when pushed a little way down into the sand, is instantly extinguished.

Pushing cigarette into sand puts it out instantly.

Ten Flashlight Batteries Are Power Source of This Model Balsa Cruiser



This drawing shows how the parts of the boat are arranged, with the five pairs of flashlight cells in the hold. Note the step in the bottom of the hull and arrangement of switch and motor.

FLASHLIGHT Cells Drive Air-Prop Cruiser

by **HI SIBLEY**

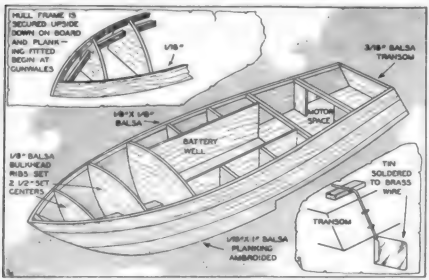
This neat model cruiser is driven by a small electric motor which derives its current from flashlight batteries, and is different from most boat models in that it is driven by an air propeller rather than an under-water screw. Balsa wood is recommended as proper material for its construction.

FIVE pairs of flashlight batteries costing fifty cents and a small construction set motor retailing for $1.25 make up the power plant of this trim little all-balsa cruiser, designed and built by Alfred Neth, of Pasadena. It cruises about at a brisk speed and, unlike clockwork or rubber-band motors, runs for a considerable period without seriously draining the batteries. It is best, however, to shut off the current at intervals of one to two hundred feet to rest the tiny batteries.

Mr. Neth has selected balsa for his hull, inasmuch as this light wood is sufficiently strong and easily worked. All seams and joints are secured with ambroid, which is waterproof.

To copy this, the best plan is to lay out the gunwale outlines on a flat board. Build up the bulk-head ribs of ⅛ in. balsa, and bend the ⅛ in. sq. balsa gunwale strips around them, working with the hull upside down. A ⅛ in. sq. spruce strip serves as the stem and keelson. This is bent to shape by steaming in the spout of a teakettle, and held in a form made of pins on a flat board. When it has set, it can be installed, holding the forward five ribs in position.

The two after-ribs and transom, or 3/16 in. stern piece, are held in position temporarily by a balsa strip across the bottoms. For planking use 1/16 in. sheet balsa about one inch wide. Begin at the stem and work towards stern, ambroiding at each rib. Gunwale planks should be put on first, working successively toward the bottom of the hull, which will be toward the top in this upside-down position. Toward the keelson it will



Showing how the hull is built up of balsa wood. Seams are secured with ambroid, which produces practically a one-piece waterproof job.

be necessary to fit the planks and trim them to shape, so that they lie flat against the ribs and edge-to-edge. Properly applied, ambroid makes a solid sheath of the planking which cannot be removed without tearing it to pieces. Ambroid is a marvelously tenacious cement, and will hold metal as well as wood.

Note that a step is made on the bottom of the hull, 13 in. from the bow. Forward of this step the bottom is rounded; back of it the hull is flat and sides are at right angles to it.

From the two central bulkheads cut sections about 3 in. wide to make room for the battery well, and a section must be cut from the rib nearest the stern to accommodate the little motor.

Before building the crowned forward-deck, install batteries and motor. The latter is held in place by two cross-pieces set over the motor feet. For best results and to prevent broken connections, solder the connecting wires between the batteries, put a strip of balsa between the two rows (so they will straddle the keelson) and bind the group together in one unit with electricians' tape. This prevents shifting in the hull and upsetting balance. A small tin fan soldered to the forward end of the armature shaft helps keep the motor cool.

Build up the after-deck, with cabin and propeller frame so that the entire assembly can be lifted off. Mr. Neth has used mahogany plywood, about 1/16 in. thick, for this construction. It makes a very neat and substantial job, though clear balsa will serve as well and is much lighter, of course.

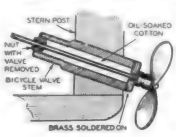
Toy construction-set parts, always available and inexpensive, are used for the prop shaft, bearing and pulleys. The brass bearing is set in a balsa block supported by four spruce struts, and should have an oil hole on top. Use ¾ in. pulleys on motor and prop shaft, and have them properly aligned. By applying beeswax to the string belt it will not slip, even though fairly loose. By all means have prop run freely. Too tight a belt will bind and run down batteries quickly.

A small radio switch can be purchased for 25 cents, and is set in the after-end of the cabin. Any other contact will do, provided it is not cumbersome.

Before testing out in the water, give the hull two coats of lacquer. Raw balsa will absorb water like a blotter and ruin the craft.

Watertight Bearing From Valve

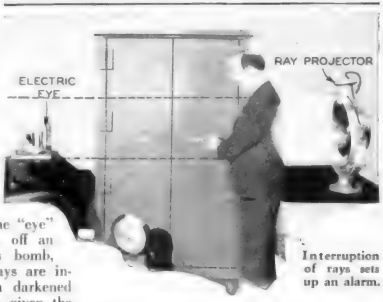
KEEPING a propeller-shaft bearing watertight in toy boats is usually a problem for the model builder. The practice has been to bring a section of tubing up above the water line, but that has disadvantages in certain types of boats, especially those driven by rubber bands where all the space between bow and stern post is valuable. By cutting off the valve stem of a bicycle tire and soldering a piece of brass to the lower end a first class "stuffing-box" can be made. Filled with oil-soaked cotton the shaft can be packed by screwing down the valve nut after the valve has been removed.



Ultra-Violet Rays Set Off Alarm to Trap Safeblowers

INVISIBLE ultra-violet rays projected toward the door of a safe and the new well known photo-electric cell or "Electric Eye" are the essential parts of thief detector, shown in the photo at the right, that has recently been perfected for protecting safes from robbery.

When the burglar approaches the safe so protected he interrupts the beam, which fact is noted at once by the "electric eye." The impulses set up in the "eye" are amplified and made to set off an alarm or explode a tear gas bomb, asphyxiating the victim. The rays are invisible both in a lighted or a darkened room, and an effective alarm is given the moment the thief crosses the beam. Any tampering with the mechanism also sets off the alarm, which operates till turned off.



Interruption of rays sets up an alarm.

Air Pump Clears Drain Pipes

CLEANING drain pipes is a constant cause of unpleasant work, but with the use of the new Air Pressure Drain Pipe Cleaner recently placed on the market the task is lightened both in point of effort and cleanliness. Air is pumped into the cleaner which is shown at the left, up to a pressure of 80 pounds, and released for cleaning drain-pipes by pulling the trigger.

The clogged pipe is first filled with water. When the air pressure is released the water in the pipe acts as a battering ram and removes the obstacle.

Precautions for Gas Refrigerators

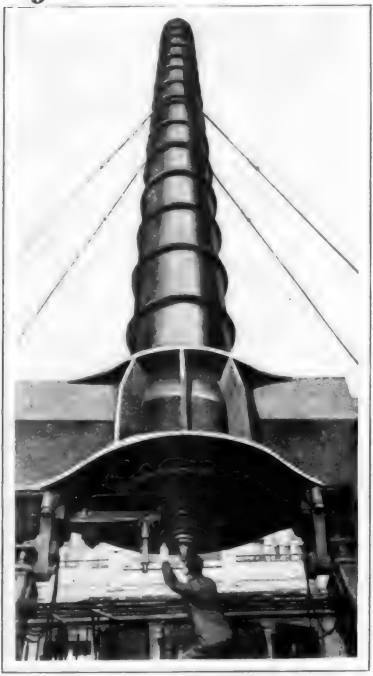
THREE precautions to safeguard the use of household refrigerators using gas have been put out by the New York health commissioner. To prevent injury and death from these refrigerators the owner should: never sleep in the same room with a gas refrigerator; keep all such rooms properly ventilated and segregated from the rest of the house; have a competent authority from the health department inspect the refrigerator every so often. Following the above precautions will probably avoid fatalities.

Oil Gun for Light Machines

A HANDY oiler that delivers that "squirt" where you want it and when you want it when oiling up the family car or the farm machinery is shown in the photo below. Pulling the pistol-like trigger forces the oil out of the nozzle. The device is made entirely of metal, with very few parts to get out of order.

A force pump, operated by trigger, ejects oil.

German Telescope is



Above is shown an astronomer at the eyepiece of the mammoth new telescope at the Treptow observatory near Berlin. The 70-foot steel barrel weighs 22 tons, and has lens 28 inches in diameter and a foot thick. Note its resemblance to a big gun.

A NEW departure in the way of design and operation of high power telescopes has been effected at the Treptow astronomical observatory, near Berlin, which is one of the best in Germany. Of a design that is distinctly unique—it might be called modernistic—the new mammoth telescope, shown in the photo at the left, has many features that add immensely to the facility of star-gazing.

One of the chief features of the new telescope is the barrel. It is built in sections, and resembles at a distance a war time "big bertha." Because of this the inhabitants of the surrounding territory have given it the name of the "Peace Gun." The barrel is 70 feet long, with a weight of 22 tons; the lenses have a diameter of 28 inches and are a foot thick. Three months were required in the grinding and polishing of the lens which magnify the stars to a size where all the details of the surface of distant planets are plainly visible.

The mechanism for focussing the telescope on the distant stars merits special attention. The entire instrument with its subsidiary equipment hinges on a huge axle 8 feet long which supports both the barrel and two eleven-ton counter weights. This axle is geared to a powerful motor which gives elevation to the barrel, while rotation is achieved by rotation of the platform. The mechanism is so arranged that once a star is brought into focus it can be followed in its course through the heavens without further adjustment. The astronomer is thus relieved of the necessity of changing his position as the position of the observed planet changes. He merely needs take a single position for observation and the mechanism keeps the star in focus. Steel girders form the major support of the entire construction, and the barrel of the telescope is braced rigidly with heavy cables. The total weight amounts to more than 130 tons. The instrument is protected by a gigantic canvas cover during storms.

UNIQUE in Design

The telescope is unique in design and closely resembles a "Big Bertha." Although located out of doors, it can be protected from storms by a canopy.

The entire telescope is mounted on a revolving platform, and the barrel is supported by a huge axle which is geared to a motor. The electrically controlled mechanism keeps the telescope focussed on a star moving across the sky, so that the observer at the eyepiece need not change position. Note the human figures in the photos, which help to give an adequate idea of the size of the thing.

Here's an interesting testimonial to the widespread interest in model boat building. These six lads of Englewood, N. J., have turned out as neat an assortment of model boats as Andy has seen in months.

Here's Howard Wagle's Anzani-powered Heath Parasol. A neat looker and a great performer! Wagle is winner of free flying contest No. 7.

A four-car freight train and caboose pulled by a working model locomotive run by steam. This fine specimen comes from Boulder, Colorado.

Fuselage of a Lincoln Sportplane built from complete plans published in Modern Mechanics.

S. B. Sanderson, an MM fan, is also a model maker of no mean note. Here he is shown with models he has built—a sloop, and two ships.

MORE pictures from the photo album—and maybe you don't agree with Andy that they're red-hot examples of the kodak-snapper's art. Models and airplanes have the call on this page—all goin' to show what the fans are interested in. For example, cast the old eye over the Lincoln Sportplane fuselage shown above. If one look isn't enough to make you want to get up there chasing clouds and flirting with eagles, hawks, and such-like denizens of the upper air, as the poet says, then I miss my guess. And what makes me feel especially frisky is the fact that this Lincoln is only one of hundreds of ships that have been built or are now under construction from MODERN MECHANICS plans.

And boats! When I saw that picture of those ship models I caught myself reaching for the red bandana to wipe off the spray.

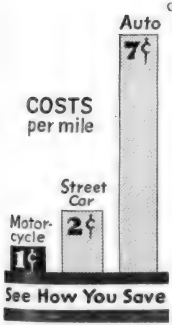
(Continued on page 182)

GREAT SPORT
-and it Saves Money!

RIDE a motorcycle — there's a thrill in every mile! Soar over hills like a swallow—swoop down the highway past the car parades—or just loaf along a country lane with your purring motor for company!

Ride away from the heat and the traffic. Get out into the country. Join the jolly Harley-Davidson bunch on their outings and tours. Feel the red blood race through your veins as your motorcycle leaps eagerly to your touch on the throttle.

Forget expense! You can travel by Harley-Davidson as cheaply as 1¢ per mile, including everything! And the motorcycle is easy to buy, too—your dealer offers a Pay-As-You-Ride Plan that will scarcely dent your pay checks!



Ride a

HARLEY-DAVIDSON

Let your nearest dealer show you our Single and Twin models — priced from $260 up, f.o.b. factory.

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Interested in your motorcycles. Send literature.

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New! Different! Dr. Harlan Tarbell, Famous Magic Wizard, teaches you Big Tricks, Illusions, Stage Stunts, "Patter" and the Principles of Magic. You learn easily and quickly at home by mail. Earn $250 to $1,000 a month. Write today for free literature and details.

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Gain that magnetic popularity that makes you the center of any crowd. Why envy others' skill? You can learn Magic yourself, quickly, easily—at home—by mail—during your spare time!

WRITE! Mail coupon now for free Magic literature telling all about the great Tarbell Course in Magic.

Get Our Low Prices and Easy Payment Plan.

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1926 Sunnyside Avenue, Chicago, Ill.

Tarbell System, Inc., Studio C-235
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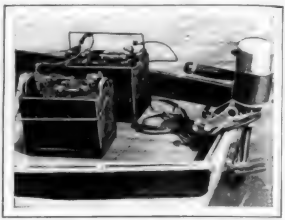
Name .....

Address .....

..... *Age* .....

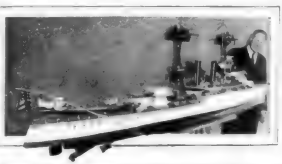
Andy Struts His Photo Album

(Continued from page 180)



Jack Blane, of Portland, Oregon, sends us this photo of an electric outboard motor he built from an Essex starter motor and Johnson parts.

GREAT for canoes, the little conversion from gasoline to electric drive shown above is the invention of Jack Blane, Portland, Oregon, double M fan. I suggest this'd make a sweet way to drive a canoe—two high amp./hr. storage batteries in multiple should last three or four hours.



George W. Simpson and his electric ship model.

SPEAKING of model projects, look at the beauty George Simpson has built. This is a model of the Memphis, and is driven by electricity. Twin,—no triple, screw job it is, too. The guns really work, being 22 caliber. You can see the airplane launching catapult on the stern deck and we are informed that the model can really put off a scout model airplane. It is equipped with radio controls, is the ship, and represents about $4000 worth of time, labor and materials. Little searchlights really light up the ship at night, and there is a set of little gigs and lifeboats which are really launchable from davits.

(Continued on page 184)

YOU STEP IN — CLOSE THE DOOR AND FLY!

Regal Convenience for the First Time in a Light Plane!

Light airplanes have always been light without regard to comfort or convenience, but the new **HEATH PARASOL** has all the comfort and convenience of the $10,000 rich man's plane.

PERFORMANCE

Leaves the ground in 4½ seconds.
Climbs 200 feet in traveling 300 feet.
Travels 45 miles on a gal. of gasoline.
Carries greater useful load than its own weight.
Climbs to 16,000 feet.
Stowed wherever you can store your car.
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80 M.P.H.
Glides 2 miles for every 1000 feet of altitude.
Quickly converted to glider or seaplane.
Carries a useful load of 300 lbs.

Buy, build, but fly a HEATH PARASOL, THE FASTEST and most practical airplane for the power in the world.

THE PARASOL SILHOUETTE

$975.00 Ready to Fly Chicago
$199.00 for Complete Bill of Material

Ten cents in stamps or coin brings large illustrated booklet.
Parts may be purchased on cash or partial payment plan.
Get started on only an investment of $12.00.

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SUCCESS IN RADIO

YOU, too, can be trained for a worth-while radio job ...Clip this coupon now and send for this FREE BOOK...Read it page by page...see for yourself why thousands of fellows just like you are now on the road to success in Radio... why hundreds of men are now cashing in on RCA Institutes' practical training. This free book gives you 40 fascinating pages of pictures and text, all about RCA Institutes, the only school that is endorsed by the Radio Corporation of America...The school that actually is a part of the great world-wide radio industry.

EASY TO LEARN RADIO AT HOME IN YOUR SPARE TIME

Let RCA Institutes' Home Laboratory Training Course give you the real inside facts of radio...quickly and easily. Use your spare time to train for success with the remarkable outlay of screen-grid apparatus given to every student of this course. You learn how to solve every radio problem such as installing, repairing and servicing fine sets. You also learn ship, shore and broadcast station operation. This is the training that will help *you to make money in radio!*

RCA GRADUATES IN BIG DEMAND

For more than 20 years, there has been a well-paid position in Radio waiting for practically every graduate of RCA Institutes—mechanics, operators, service men, etc. Only the vast resources of RCA could give you this practical training...

SEND FOR THIS FREE RCA BOOK "RADIO...THE FIELD OF UNLIMITED OPPORTUNITY"

Start today on the road to Success in Radio....Send for this FREE BOOK. Every page is packed with pictures and text telling you all you want to know about RCA Institutes, the oldest and foremost Radio training organization in the world. Radio can easily be YOUR ROAD TO SUCCESS...That's why you should

Clip this Coupon NOW!

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A Division of Radio Corporation of America

RCA INSTITUTES, Inc.
Dept. MM-8, 75 Varick Street, New York

Gentlemen: Please send me your FREE 40-page book which illustrates the opportunities in Radio and describes your home laboratory method of instruction

Name.....

Address.....

Occupation.....

The SMB Spindle Sounds Off

(Continued from page 182)

WHAT becomes of follies beauties? Freddie Resico, winner of M-M Flying Contest No. 1, is now a monk at Selfridge field. Turned out to be a natural born flyer. Bob Dumas, Win Your Wings man No. 2, went to Braley. They burned down the day he got there, and he took the rest cure until Braley got built up again. Bob is now working on his hours. Lew Slemmer, sign painter of Upper Sandusky, and letter writer extraordinary, went to Lincoln, and soloed in 6½ hours. That's flyin'. Lew kept running a column in his home town paper all the while he was at Lincoln. Told 'em all about the ups and downs of the student peelot. Man No. 4, Wallace Sweeney, is putting in his time at Roosevelt field down on Long Island, and is teaching sparrows what good stall landings are like. Young Bob Ringle, Chicago speed demon, went to Von Hoffmann at St. Louis, and is tickled pink at the way he is being treated. All the boys seem to go nuts about their schools, and think that each one is the greatest peelot factory on earth. So far I give 'em credit for not having even peeped about its being the "little field where Lindy learned to fly." Atta boys! Harold Garret, winner No. 6, is probably on his way to Roosevelt now, and Howard Wagle, winner of contest No. 7, is coming in from the coast to hit the tarmac at some school he has not yet chosen. Switch off, gas on!

Here is Dick Pingston's Anzani motored biplane —a wee one—all home built. It flies!

(Continued on page 188)

In accordance with our aim to be first in giving the best we are now offering a Genuine Q R S DeVRY Projector. This model is not a flimsy toy construction, instead it is built with Mechanical Sturdiness that will appeal to Dad (who can also use this machine when company comes).

This Q R S DeVry Projector is so different, so far outclasses the Toy Machines that are now offered that we would not attempt to compare the two. It really compares favorably to the real high price machines and has most of the parts exactly that the high priced machines have.

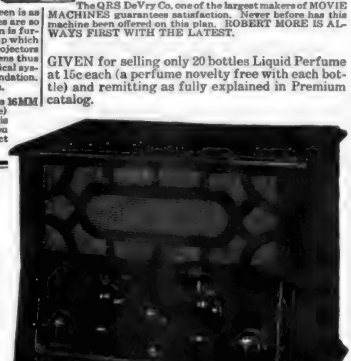
On all high price machines selling from $50.00 to $100.00 the precision film Claw movement is used. This is what feeds the film and is necessary for steady perfect projection. This precision film claw movement is very expensive yet the Q R S DeVRY machine we are offering has this feature. In addition the important working parts, gears, etc., are MACHINED (so they won't wear out) while those of toy machines are stamped out and won't last long. Another important feature is the Spring Film Gate that is used on this machine to hold the film firmly in position, so that no matter what speed you decide to turn the crank the film will not slip out of position and will project perfectly same as at low speed.

With the Q R S DeVRY machine the motion on the screen is as natural as with high price machines, yet the principles are so simplified that a child can operate it. The illumination is furnished by a 110 Volt 50 Watt G. E. Milltype Mazda Lamp which we furnish with the machine; unlike most low priced projectors this lamp has a set filament directly OPPOSITE the lens thus giving 100% illumination. The projection lens and optical system being made by DeVRY needs no other recommendation. Its the best. This machine provides for rewinding film.

The film used is 16MM (Narrow Guage) one foot of which is equal to 2½ feet of standard film. This is the same film used in all Home Movie Projectors. You can rent, buy, borrow favorite releases and we also direct you where you can secure free use of films.

The Q R S DeVry Co. one of the largest makers of MOVIE MACHINES guarantees satisfaction. Never before has this machine been offered on this plan. ROBERT MORE IS ALWAYS FIRST WITH THE LATEST.

GIVEN for selling only 20 bottles Liquid Perfume at 15c each (a perfume novelty free with each bottle) and remitting as fully explained in Premium catalog.



Nationally known set licensed under RCA patents. Gorgeous Cabinet, size 17x22x13 inches. Regular retail price $60.00. GIVEN for selling 20 bottles liquid perfume at 15c a bottle (perfume novelties free with each bottle) and remitting as explained in Premium Catalog sent with Perfume. Write today, now—Send no money—we trust you.

ROBERT MORE CO.

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The Four Best True Crime Mysteries

August issue on sale JULY 10th

The Body in the Bathtub

Jake Nesbitt recoiled in horror as he gazed upon the mutilated body of his beautiful young wife in their Troy, Ohio, home. Read how detectives solved this gruesome murder mystery.

Trapping the Lamar Wolves

Bandit guns blazed a red trail of death as the fierce Fleagle gang terrorized Colorado. Their capture makes one of greatest real detective stories you've ever read.

A Ticket to the Gallows

Chief of Police James L. Beavers, of Atlanta, Georgia, tells the sensational story of a young bandit who paid his debt to society on the scaffold.

Mystery of the Headless Corpse

A body without a head, a triple grave, and then a fifth skeleton—all added to the reign of terror that swept over San Fernando, Calif., until the mystery was solved.

In the AUGUST issue of

Startling Detective Adventures

If your newsdealer is sold out, send 25 cents (stamps or coin) to Startling Detective Adventures Magazine, Fawcett Publications, Inc., Minneapolis, Minn., and a copy of the August issue will be mailed to your address.

Ain't Life Wonderful! *By Mason*

Button Rupture Newest Way
(Without Cruel Pressure!)

Ends Truss Torture Now or Never

SCIENCE now advises discarding steel springs, barbarous leg straps, and other cruel harness that press against the rupture and thus may prevent nature from healing it. A new sensible method has been perfected after experience on more than 50,000 cases—called Magic Dot System—entirely different from any other way. Instead of cruelly "pressing," Magic Dot System "buttons" rupture. Hence many report they can now exercise and work in vigorous occupations in comfort and security. Many, too, report that the protrusion has disappeared.

Rupture Help Breathes Air

With this 1/25th oz. device is a new kind of pad, air-porous and washable. It actually breathes air and does not slip off the rupture—a feature that many say is lacking in the ordinary appliance. In fact, Magic Dot System is so superior and different that it is praised by physicians as "an entirely new departure." Users report they have forgotten they are wearing it. But don't buy it yet.

SEND COUPON FOR FREE SAMPLE AND 10-DAY TRIAL OFFER

By a special arrangement you can now have the Efficiency Model sent to your home on 10-Day Trial. The coupon below will bring full details of this offer, and will also bring you a free sample of its amazing flesh-soft material. Act now for quick relief. Write your name and address on the coupon and mail it today.

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New Science Inst., 2575 Clay St., Steubenville, O.
Please send me a free sample of the Airtex material that breathes. Also full details of your offer on the Efficiency Model of 10 Days' Trial by actual wear. This request does not obligate me in any way.

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NOW! Oil Heat at Amazing Low Cost

TURNS OIL INTO GAS

WORLD'S LOWEST PRICED. Cheapest to Operate Oil Burner. Amazing new invention turns oil into gas through patented Crystal Mineral Wick. REVOLUTIONIZES FUEL COSTS. Burns oil and air. Won't overflow or flood. Easily, quickly installed in any stove or furnace. Simple adjustments. Anybody can do it. Automatic Control — Room Thermostat. Guaranteed. Quiet. Amazing offer if you act now!

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Dealers
Quick Sales—Big Discounts
—some report as much as $10,000 to $50,000 annually. Write today!

Make Your VEST POCKET BRING YOU $400. A MONTH

Brand New

An article that arouses instant curiosity. Quickly demonstrated and conveniently carried in vest pocket. Protection for everybody against robbers, criminals, morons, vicious dogs, etc. yet it is not classed as a weapon, because absolutely harmless.

"Sold 17 First Day Out"

writes Hansen of Northern Illinois. Hayes of Minn. wires "Sold my first dozen in five hours. Send 3 Doz. C. O. D. at once." Agents make $2.55 on each sale. Big extra profits on quantity. Prospects everywhere—men, women, banks, theatres, merchants, etc. You should close at least 40%.

Looks Like A Fountain Pen

INSTANT TEAR GAS PROTECTION
WITHOUT INJURY TO ANYONE

Two Tear Gas Cartridges Free
with every gun. You make 20 cents each on every extra cartridge sold.

Exclusive Territory
still open. Especially attractive proposition to men controlling force of salesmen. Send Coupon for details regarding How to get Free Demonstrator, etc.

Women are not afraid to use the Atlas Gun. Greatest protection for women ever invented.

800 Atlases recently ordered by banks in one territory alone

ATLAS TEAR GAS FOUNTAIN PEN GUN

Atlas Tear Gas Co., Chicago, Ill.
Ogden Park Station, Dept. 66

Gentlemen: Please send me particulars regarding your Fountain Pen Tear Gas Gun agency. Also tell me how I can get a Demonstrator and two cartridges Free

Name .....

Town .....

St. or R. F. D. ..... State .....

Short Scripts from Andy's Spindle

(Continued from page 184)

This splendid model of a Ford Tri-motor was made by a reader at Cleveland Welding School.

MORE short scripts from the spindle: Vance Aircraft Co., Kerman, Calif., tells me they've got a new lightplane coming out with the 25 h.p. Cleone 2-cycle motor. M. Russell Kump, Springfield, Ohio, where magazines are also printed, suggests that the Darmstadt type of glider would make fine how-to-build writing. Mebbe so, Russ. We'll soon see. We have a man coming from Joimany to put us in the know on Dutch flitting. Tell you later.

* * *

Harry Holcomb, boilermaker reader from Atlanta, sends me this jewel: 600 boilermakers had a convention at Atlantic City last week. They took an excursion steamer for a short trip. The boiler went on the bum and the 600 boilermakers couldn't keep up steam enough to reach port. Haw! Haw! True—believe it or not.

* * *

H. Lindbergh, of Livermore, Calif., is building a lightplane, he tells us. Great! Joe G. Heck, Beeville, Texas, has built another light step boat for outboards.

(Continued on page 192)

Build Your Own Plane!

Experience the thrills of zooming, diving, and chasing clouds thousands of feet above old Mother Earth—fly your own airplane, which you can build from complete plans presented in **Modern Mechanics' FLYING MANUAL.** You can choose the type of plane you prefer from the numerous designs in the Manual. Is it speed you're after? Then pick the Baby Bullet Raceplane, fastest of its type ever built. Or perhaps you prefer a sportplane—then choose the Alco. And there's the Lincoln biplane for those who favor that type, and the Northrup glider for enthusiasts in this latest thrilling aerial sport.

These are only a few of the good things in the book, which includes articles on how to make your own airplane engine—airplane welding—why an airplane flies—flying your own plane—and scores of other features by such famous pilots and plane designers as Ivan S. Driggs, Gene Shank, Orville Hickman, J. M. Allison, Weston Farmer, Stewart Rouse and Ed Heath. You'll find them all in the

FLYING MANUAL

1930 EDITION

You can get a copy of the Flying Manual from your nearest newsdealer or bookseller. If he cannot supply you, send one dollar—in stamps or coin—to Modern Mechanics, Minneapolis, Minn., and your copy will be sent you immediately. Modern Mechanics' Flying Manual is a Fawcett publication.

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Live producers can earn up to $100 a week and more selling Gibson extra fine men's made-to-order all-wool suits at $23.50, direct to wearer. Most liberal commissions in advance, biggest values, with bonus, to producers. **Frequent opportunities to get own clothes at no cost.** We deliver and collect. 639 cloth samples, over 100 styles and complete outfit in handsome carrying case furnished FREE to ambitious men who are willing to hustle and earn up to $100 weekly. Write today.

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Size	Rim	Tires	Tubes	Size	Tires Tubes
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28x4.75	19"	2.65	1.15	32x3½	2.45 1.10
29x4.75	19"	2.65	1.15	33x4	2.95 1.30
29x4.95	21"	2.90	1.35	33x4	2.95 1.30
30x4.95	20"	2.90	1.35	29x4.40	3.30 1.45
31x4.95	21"	2.95	1.35	31x4.40	3.30 1.45
32x4.95	21"	2.95	1.35	32x4.40	3.30 1.45
33x4.95	21"	3.20	1.40	30x5	3.60 1.75
34x4.95	21"	3.20	1.40	31x5	3.60 1.75
35x4.95	21"	3.20	1.40	32x5	3.60 1.75
36x4.95	20"	3.85	1.55	All Other Sizes	

Send only $5.00 deposit with this ad for each tire ordered, balance C.O.D. If you send cash in full, deduct 5%. You are guaranteed a year's service or replacement at half price.

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"X-RAY" CURIO

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"Silver Only"

BOYS BIG FUN. You apparently see thru Clothes, Wood, Stone, any object. See Bones in Flesh. FREE PKG. radio picture films; takes pictures without camera. "You'll like 'em." 1 pkg. with each 25c order.

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Simple and easy. Just write, typewrite, draw or trace on dry stencil, place in position and print up to 1,000 copies per hour. All supplies and instructions furnished. Guaranteed 10 years. Prints any size from postcards to sheets 9x14. Does beautiful work.

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The World's New Navies

(Continued from page 43)

engagements between the English and German fleets. Admiral Jellico himself pointed out in his book that while England was losing the *Good Hope, Monmouth, Queen Mary, Indefatigable, Invincible, Defense* and *Warrior*, German ships, hit far more frequently by gunfire, torpedoes, mines and bombs, were limping home to be repaired so they could fight another day.

The Germans upset all the treaty cruiser calculations a couple of years ago when they launched their "pocket battleship," the *Ersatz-Preussen*, a 10,000-ton cruiser armed with 11-inch guns, and a trio of fast light cruisers, the *Koenigsburg, Koeln* and *Karlsruhe*, which were quite unlike anything seen in warships before.

Electric welding, to save overlapping plates and tons of rivets, Diesel engines, to cut down the fuel load, and wide use of light weight alloys for machinery and interior fittings, enabled them to build a 10,000-ton cruiser with battleship qualities, including fairly heavy armor and 11-inch guns instead of 8-inch.

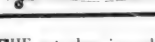
That the *Ersatz-Preussen* is a success, however, is seriously questioned by naval designers. To begin with, it is a compromise ship, designed for two widely different purposes. Its heavy guns and high speed indicate it is intended for use in the Baltic Sea, where only a few obsolete Russian battleships outrank it in offensive power. But its 10,000-mile cruising radius and speed also betoken a commerce raider for distant service. Professor William Hovgaard, at the meeting of the Institute of Naval Architects in Rome last fall, pointed out that the Dutch, because of limited finances, had tried to build a two-purpose warship in the *Piet Hein* class back in 1894, but soon abandoned the effort as unsatisfactory.

One trouble with the *Ersatz-Preussen* is that it hasn't the freeboard for a ship of its speed in the open sea, and, as a platform for 11-inch guns, it may be found to be both wet and unstable.

The Diesel engines, of 50,000 shaft horsepower, are twice as powerful as any previous Diesel installation, and therefore something of an experiment, but one which their past experience with Diesels enables the Germans to make with more assurance than any other nation might have.

Dick Pingston Sends Andy a Note

(Continued from page 188)



THE cut glass ice cubes go this month to Richard E. Pingston, flyin' hombre from 16248 Robson Ave., Detroit, Mich.

Shop Mail Box
Modern Mechanics
Dear Sir:

I have been reading your M.M. mag for quite a while now and think it the best, most descriptive and up-to-the-minute magazine on the market. Andy's Shop Mail Box is one of the bright spots I always look for.

Enclosed in this letter are pictures of a little ship I built and am guilty of designing. This little sky-buster is three years old and has had lots of air abuse. Now I would like to hear from some of the gang that have built ships and see if we can't get together in getting a light plane club going. A small active club flying enmasse can do more for the good of aviation than all the written advertising in the world.

My little ship's specifications are as follows:

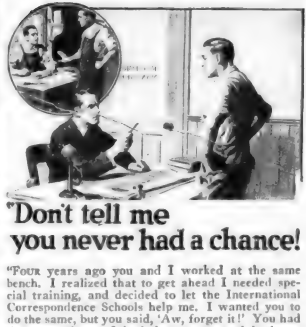
Wing spread—16 feet.
Body length—12 feet, 6 inches.
Wing area—88 square feet.
Aileron area—12 square feet.
Flipper area—8 square feet.
Rudder area—5 square feet.
Lift in lbs. per square foot—5.75.
Wheel tread—4 feet.
Radial motor Anzani—40-45 h.p.
Weight in lbs. per h.p.—12, ship loaded.
High speed—140 m.p.h.
Landing speed—35-40 m.p.h.
Cruising radius—200 miles.
Total weight with 165 lb. pilot—500 lbs.

. . . . that high speed figure is believable and highly remarkable, Dick. This seems to be a real cart d'aire! Is she quick on the controls? Nemmine, Gang. Read on:

All wood construction in body with tie rod bracing. Longerons, I beams built up with web and gusset plates; compression struts the same. Cloth covered with aluminum where needed.

Wings, I beam one piece spars, solid wood ribs with lightening holes. Cap strips top and bottom. Tie rods used in wings for drag bracing.

I am gradually acquiring the facilities to build these little ships on production, only a few changes being made. The body will



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"FOUR years ago you and I worked at the same bench. I realized that to get ahead I needed special training, and decided to let the International Correspondence Schools help me. I wanted you to do the same, but you said, 'Aw, forget it!' You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

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Right now over 180,000 men and women are preparing themselves for bigger jobs and better pay through I. C. S. courses.

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Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject before which I have marked X:

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be steel tube construction with split type landing gear; and believe you me, that will make it one of the finest flivvers in Michigan.

Hoping you find space to include photograph in your next issue, I remain,
Yours for happy landings,
RICHARD E. PINGSTON.

Had quite a treat the other day. I sat at the old typemill expressing my views on the blurb at the head of this column when who should walk into the office but none other than Jack Dempsey — William Harrison himself. Capt. Billy, publisher, introduced us and we had a good little gam about lightplanes. Jack'd make a marvelous stick an' flipper handler, and is interested in aviation. Clear eyed, bright of smile, soft voiced and bronzed like a copper statue, it seems he had dropped into these parts to referee a fight. And incidentally he wanted some dope from Capt. Billy about African hunting, so he killed two birds with one stone—saw Capt. Beely and looked old double M over. Imagine my surprise, Gang, when Jack said he'd found this column interesting, and that he sat up one night till the wee sma' readin' it. Hola, Jack!

* * *

I couldn't help thinking what Jack's 200 lbs. of dynamite beef could do if he swung on an OX5 prop at the w.k. signal, "Contact!" The plane could take off coasting on the extra revs!

* * *

Babe Ruth, who wrote our last baseball yarn, is another who ought to try swinging a prop. Can't you feature an OX5 getting twisted for a homer?

* * *

You ought to see the cargo of fine things that will appear in the next, or 1931 edition of the FLYING MANUAL. Flyin' boats, two-seaters, 'neverything! Watch the newsstands for it in October of this year.

(Continued on page 195)

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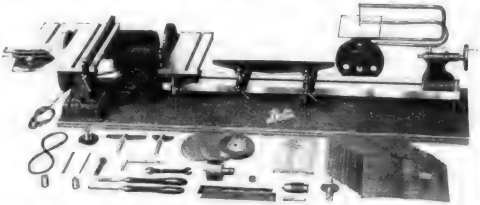

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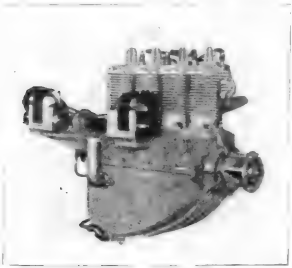
(Continued from page 192)

Designer of the Air King, Pheasant, and Starling —Orville Hickman.

THE calm-eyed countenance off the left wing here is the physimahogany of none other than Orville Hickman. Orv, as he is affectionately called by all who know him, is an old hand on MODERN MECHANICS, and some of his lightplane how-to-builds top the list for popular appeal. Notably might I mention the little glider motor, the Lawrence Conversion story, and others. As with all M-M authors, he "knows his stuff." Expert welder, experienced aircraft worker, skilled and practical designer, Orville is unusual in that he has the amateur builder's slant on what will click, and knows how to tell about it.

I consider the Heath airplane engine the best lightplane engine on the market. It is the most highly developed, has power and snap out of all proportion to its size, is reliable as a church and vibrationless. What thinkee of the dual ignition job below?



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1. What aviator was first to perform the inverted falling leaf? (See page 79)

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2. Who was first to loop-the-loop in a glider? (See page 79)

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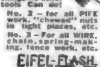
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3. State what you know of the Schneider Trophy races. (See page 79)

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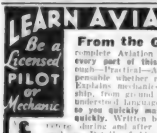

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Charting the Air for Flyers

(Continued from page 56)

unfavorable flying conditions. At times when the central valley is choked with fog the sun is usually shining along the coast, and vice-versa.

Occasionally both routes are simultaneously unfavorable, but the printer telegraph system speedily reveals such a condition. When such a condition prevails aviators hop over the high Sierras to fly through the great trough of Owens Valley or Death Valley, where the sun always shines. At the same time they pick favorable winds by selecting flying altitudes according to their wind reports. With these reports available there is seldom a time that aviators cannot pick a favorable route to their airport destination.

The flying time over the several competing commercial air lines between Los Angeles and San Francisco was formerly 3½ to 4 hours for the 365 mile route. But since science took the guesswork out of aerial navigation the schedule has been reduced to three hours and frequently less.

Very recently a twelve passenger plane in this service established a record of 1 hour and 59 minutes for the flight between San Francisco and Los Angeles, flying at a high altitude in a strong south wind. Simultaneously a similar ship left Los Angeles, and flying close to the ground in a favorable northbound wind, made the distance to San Francisco in 2 hours and 40 minutes.

Nowadays a Pacific coast pilot who bucks a headwind when nature and science have provided him with a tailwind would probably be discharged for incompetence. He'd be classified fully as unintelligent as a captain of a ship who deliberately pushed against the current of the well charted gulf stream in making a run from New York to Miami. Aviators now make use of the same sort of intelligence as a competent mariner in piloting airplanes through favorable winds, all of which is made possible by the new science of aerology.

Thus perhaps nothing can be done about the weather, but this much is being done to keep pace with it.

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4. Why do you wish to become an aviator? (See page 79)

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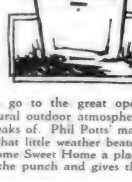

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The Perpetual Motion Train

(Continued from page 67)

petual motion machinery. The first one of these patents was published on March 9th, 1635, and concerned of the many wheels with permanent "over-balance".

In 1770 already the philosopher, Sir James Ferguson, tried to convince the world of the impossibility of perpetual motion. He, too, built a machine with swinging levers and shifting weights, which was to prove the impossibility of the principle of permanent over-balance.

But in spite of that people kept on inventing. When the first bicycles with chain transmission were put on the market, the idea to gain something from the nothing received a new impetus. One inventor conceived the exceedingly simple idea that an endless chain hanging loosely over the crown of a wheel would create an over-balance.

Even Leonardo da Vinci, the greatest technician of his time, could not withstand the temptation to present to the world a "perpetual motion." He designed a wheel on the same principle of over balance, but was to rest principally on one side of the wheel only and a secondary roller or wheel was to guide the chain in such a way, that it would always run onto this one side of the large wheel only. With a real heavy chain, the inventor hoped to be able to set a dynamo into motion. But the chain remained immovable, for the two parts could not be brought out of balance.

The absurdity of a permanent over balance becomes evident at once, if one considers that it takes the same amount of power to lift a weight as is gained by lowering same. Not only can nothing be gained in that way, but the loss of power resulting by friction, will inevitably bring the machinery to a stop after it has been set in motion.

About twenty years ago, a wheel was on exhibition in a show window in Berlin, which was turning for hours and which was considered by naive onlookers as the long hailed "Perpetuum Mobile." If the onlookers had been more patient and had stayed long enough, they might have seen a man appear in the show window about every half hour, to set the wheel in motion again.

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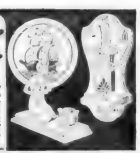

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5. What are some of the advantages airplanes have over lighter-than-air craft? (See page 79)

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Read HIS LETTER for the ANSWER

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"New hair came almost immediately after I began using Kotalko," he writes, "and kept on growing. In a short time I had a splendid head of hair, which has been perfect ever since."

This statement by Mr. Wild is but one of the many which substantiate alleged that Kotalko has stopped falling hair, eliminated dandruff or nobel ment. Invariant hair growth where the roots were alive.

Hair roots that remain in the scalp long after the surface hairs are lost, may regain their original power through proper encouragement. The process of hair growth depends on the hair roots and the nourishment they receive.

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Please send me FREE Proof Box of KOTALKO

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Building the Rabl Radio

(Continued from page 126)

sary to streamline the loop to cut down drag and at the same time enclose the loop to prevent vibration of the wires in the slip stream.

Assuming that our set is complete and wired we will proceed to get the outfit to percolating. Remembering that this is a super regenerative set we will always hear the variation frequency whistle so don't try to eliminate the peanut roaster the first time you hear it in the phones. This is one of the signs that the set is functioning. The first step after the filament is lit is to screw the Bradleyohm down until the set breaks into a quiet whistle that denotes super regeneration. Turn the dial slowly until the carrier wave of a transmitting station is picked up and then adjust the Bradleyohm for best results. This completes the receiving end of the circuit and we are ready to connect on the power supply and shoot the ether. Speaking of power supply the type of service to which the set is used will determine the best type of power supply. For the camp, plane or auto the best will be the dry cell "B" battery type between ninety and three hundred and sixty volts, depending on the tube used. For the cruising boat the same may be used, or a motor generator driven from the starting or lighting batteries will be the most satisfactory type. For the home a "B" power pack run from the lighting circuit is far the cheapest and best.

As for tubes almost any tube that still percolates will work but the UV 201 A or the UX of the same type will give satisfactory service up to a plate voltage of two hundred and fifty. The UX 210 will be OK for voltages above this. Even the little 199 may be used in a short range portable set where weight is the prime consideration. A standard "C" battery will answer for the filament supply and three of the small size 22-volt units will answer for the transmitting and receiving plate voltage with a slight alteration to the hook up.

It will be good practice if two little 22-volt units are built in the cabinet permanently in the rear above the tube shelf to answer as the receiving plate voltage.

After the receiving end of the set is perking properly get some ham who has a license to test out the transmitting possibilities of the set and remember that you

by Sam Rabl

will have to secure a transmitting license from your local radio inspector before you are allowed to put the set on the air.

The loop will possess the same characteristics in transmitting that all loops do in receiving, namely that of being directional. It will transmit and receive best in the direction in which it points. Keep this fact in mind when transmitting from a boat or plane if the loop is fixed so as to be immovable.

The cabinet should be equipped with eyes so that it may be suspended in the fuselage of a plane with exerciser cord so that vibration and landing shocks will not be a serious hazard. On a yacht the vibration will not be serious enough to affect the outfit so this can be neglected.

It might be necessary to shield the ignition in a plane to be able to receive as ignition interference presents a big difficulty. If the plane has a steel tube fuselage keep the set well away from the tubing and in all cases do not get too long a lead from the set to the loop especially for forty meter work. The loop may be mounted on the fuselage in a vertical position about four inches away from the fuselage sides and the set inside the fuselage in a position convenient to the loop. It may also be mounted under the fuselage if there is ground clearance enough.

Well now that the set is complete the rest is up to you and if the motor ever conks out if it be in plane, boat, or flivver just "Radio home."

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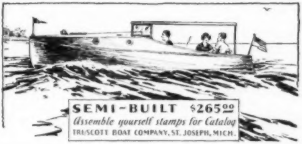
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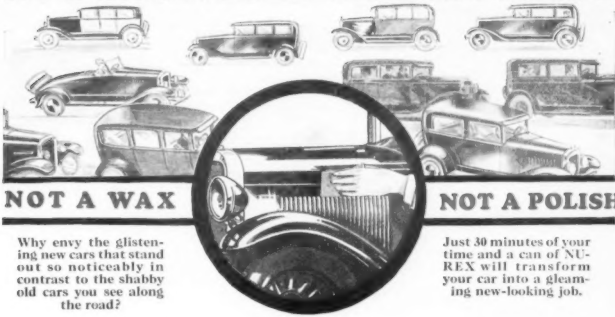

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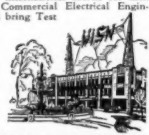

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